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INCLUDING

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(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY
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VOL. V.—ELEVENTH SERIES.

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ :—ex harum usu *bonitas* Creatoris ; ex pulchritudine *sapientia* Domini ; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata ; à verò eruditis et sapientibus semper exculta ; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

.... The sylvan powers
Obey our summons ; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet ; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep ; the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide : the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.
J. TAYLOR, *Norwich*, 1818.

. ALERE FLAMMAM.

CONTENTS OF VOL. V.

[ELEVENTH SERIES.]

NUMBER 25.

Page

I. The Microfossils of the Upper Carodocian Phosphate Deposits of Montgomeryshire, North Wales. By Professor H. P. Lewis. (Plates I.–IV.) 1

II. Descriptions of new Species of Ants (Hym., *Formicidæ*) from various Localities. By Horace Donisthorpe, F.Z.S., F.R.E.S., &c., Department of Entomology, British Museum (Natural History) 39

III. A List of the Type-hosts of the Mallophaga and the Lice described from them. By Gordon B. Thompson 48

IV. The Osteology of the Striped Bass (*Roccus saxatilis*). By Daniel Merriman. Osborn Zoological Laboratory, Yale University, New Haven, Connecticut 55

V. Beiträge zur Kenntnis der Conopiden.—V. Von O. Kröber, Hamburg 64

VI. Descriptions and Records of Bees.—CLXXVIII. By T. D. A. Cockerell, University of Colorado 82

VII. Notes on Fossorial Hymenoptera.—XLVIII. New Guinea *Thynnidæ* collected by Miss Cheesman. By Rowland E. Turner 91

VIII. Notes on Fossorial Hymenoptera. — XLIX. On new Australian Species. By Rowland E. Turner 96

IX. New South American *Helotrephidæ* (Hemiptera-Heteroptera). By W. E. China, M.A., British Museum (Natural History).......... 106

X. The Presence of living Ostracods in the Intestinal Tract of *Triturus v. viridescens*. By Donald J. Zinn, Osborn Zoological Laboratory, Yale University, New Haven, Conn. 126

NUMBER 26.

XI. A Synopsis of the Brazilian Species of *Neoelmis* Musgrave (Coleoptera, *Elmidæ*). By H. E. Hinton, Ph.D., Department of Entomology, British Museum (Nat. Hist.) 129

XII. The Ordovician Trilobite Fauna of the Shelve-Corndon District, West Shropshire.—Part I. *Agnostidæ*, *Raphiophoridæ*, *Cheiruridæ*. By W. F. Whittard, D.Sc., Ph.D. (Plates V. & VI.) 153

Page

XIII. Twenty-eight new Generic Names in Orthoptera. By B. P. Uvarov, D.Sc., British Museum (Natural History) 173

XIV. Preliminary Diagnoses of some new Species of *Mischocyttarus* Saussure (Hymenopt., *Vespidæ*). By O. W. Richards... 176

XV. On the Mode of Growth of the Skeleton in Astræid Corals. By Prof. George Matthai, Sc.D. (Cantab.), University of Lahore. 181

XVI. Entomological Expedition to Abyssinia, 1926-27: Diptera-Brachycera, *Tabanidæ*, *Asilidæ*, *Bombyliidæ*. By H. Oldroyd, M.A., British Museum (Natural History) 192

XVII. Beiträge zur Kenntnis der Conopiden.—VI. Von O. Kröber, Hamburg 203

XVIII. Descriptions and Records of Bees.—CLXXIX. By T. D. A. Cockerell, University of Colorado 216

XIX. On the First Zoeal Stage of *Dotilla sulcata* (Forskal). By M. M. Ramadan, Ph.D. (Cantab.). (From the Zoology Department (Foud's University, Cairo.)............................ 253

XX. On Two Tapeworms from a Burmese Snake. By F. J. Meggitt 255

XXI. The Food-plant of *Platyauchenia latreillei* (Castelnau) (*Hispinæ*, *Chrysomelidæ*, Coleoptera). By S. Maulik 256

NUMBER 27.

XXII. Undescribed Anatomical Structures and new Species of Reptiles and Amphibians. By H. W. Parker, M.A., Department of Zoology, British Museum (Natural History) 257

XXIII. New or little-known *Tipulidæ* (Diptera).—LVII. Neotropical Species. By Charles P. Alexander, Ph.D., F.R.E.S., Massachusetts State College, Amherst, Massachusetts, U.S.A. 275

XXIV. A List of the Type-hosts of the Mallophaga and the Lice described from them. By Gordon B. Thompson 297

XXV. Notes on the Herpetology of the East African Islands. By H. W. Parker, R. E. Moreau, and R. H. W. Pakenham 309

XXVI. Notes on Mosquitoes. By F. W. Edwards and H. E. Box 314

XXVII. Eine neue Fruchtfliege als Bambus-Schädling (Dipt.). Von E. M. Hering (Berlin) 322

XXVIII. The Affinities of the Palæozoic Pleuracanth Sharks. By Sir Arthur Smith Woodward, F.R.S. 323

XXIX. A new Subspecies of Red Deer from the Upper Pleistocene of Jersey, Channel Islands. By Frederick E. Zeuner, Ph.D., F.Z.S., British Museum (Natural History), and London University Institute of Archæology 326

NUMBER 28.

Page

XXX. Some Notes on the Dugong. By R. I. Pocock, F.R.S. (Zoological Department, British Museum) 329

XXXI. Land Planarians from the Palau and Caroline Islands, Micronesia. By Libbie H. Hyman, American Museum of Natural History, New York City 345

XXXII. Contributions on the Palæontology of Afghanistan.—Oligocene (?) Mollusca. By L. R. Cox, M.A., Sc.D., Department of Geology, British Museum (Natural History). (Plate VII.) 362

XXXIII. Notes on Species of the Genus *Pectinopygus* (s. l.). (Mallophaga).—I. By Gordon B. Thompson. (Plate VIII.) 372

XXXIV. Contributions to the Herpetology of Afghanistan. By Malcolm A. Smith. (From the Department of Zoology, British Museum (Natural History).) 382

XXXV. The Upper Valentian Ostracod Fauna of Shropshire. By J. C. Harper, B.Sc., D.I.C., A.R.C.S. (Plate IX.) 385

New Book:—Primitive Insects of South Australia. By H. Womersley 400

NUMBER 29.

XXXVI. On a further Collection of Parasitic Worms from the Belgian Congo. By H. A. Baylis, M.A., D.Sc., Department of Zoology, British Museum (Natural History) 401

XXXVII. Stray Notes on Mallophaga.—II. By G. H. E. Hopkins, M.A. 417

XXXVIII. Notes on Species of the Genus *Pectinopygus* (s. l.) (Mallophaga).—II. By Gordon B. Thompson 429

XXXIX. *Scolytidæ* and *Platypodidæ*.—61. Contribution. By Karl E. Schedl 433

XL. Notes on some Types of *Chrysopidæ* (Neuroptera) in the British Museum Collections. By D. E. Kimmins, Department of Entomology, British Museum (Natural History) 442

XLI. The Genus *Stilbopteryx* Newman (Neuroptera). By D. E. Kimmins, Department of Entomology, British Museum (Natural History) 449

XLII. The Fishes of the Gobiid Genus *Luciogobius* Gill. By C. Tate Regan, D.Sc., F.R.S. 462

XLIII. Note on the Yugoslavian Ground-Squirrels (Sousliks). By V. and E. Martino. (From the Department of Zoology, British Museum (Natural History).) 465

XLIV. *Melanagromyza coffeæ*, sp. n., a Leaf-Miner of the Coffee-Plant. By E. M. Hering 471

NUMBER 30.

Page

XLV. New Genera and Species of *Hormiinæ*, with a Note on *Hormiopterus* Giraud (Hym., *Braconidæ*). By G. E. J. NIXON, B.A., Imperial Institute of Entomology 473

XLVI. Preliminary Notes on Five new Mammals from Jugoslavia. By V. and E. MARTINO. (From the Department of Zoology, British Museum (Natural History).) 493

XLVII. The Parasites of Australian Birds and Mammals. III. Mallophaga from Sea-birds. By GORDON B. THOMPSON. (Plate X.) 498

XLVIII. Notes on the Nomenclature of Fossil Fishes.—Part I. Homonyms A–C. By ERROL I. WHITE, D.Sc., British Museum ((Natural History), and J. A. MOY-THOMAS, M.A., Department of Zoology and Comparative Anatomy, Oxford 502

XLIX. Vier neue *Hoplionota*-Arten (Col., *Cassidida*). Von FRANZ SPAETH, Wien.. 507

L. Hydracarina of Algeria. By Dr. C. WALTER, Riehen, Basel. 513

LI. Notes on the Plectognath Fishes.—III. On *Monacanthus setifer* Bennett and related Species, with a Key to the Genus *Stephanolepis* and Descriptions of Four new Species. By A. FRASER-BRUNNER 518

LII. Papers on Oriental *Carabidæ*.—XXXVI. By H. E. ANDREWES, F.R.E.S. 536

Index 537

PLATES IN VOL. V.

PLATE I.	Microfossils from the Lower Palæozoic rocks of Britain.
II.	
III.	
IV.	
V.	Agnostus and Ampyx.
VI.	Placoparia and Placoparina.
VII.	Oligocene (?) Lamellibranchia from Afghanistan.
VIII.	Pectinopygus (P.) bassani (Fabr.).
IX.	Upper Valentian Ostracoda.
X.	Mallophaga from sea-birds.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

> "   ......per litora spargite muscum,
> Naiades, et circum vitreos considite fontes:
> Pollice virgineo teneros hic carpite flores :
> Floribus et pictum, divæ, replete canistrum
> At vos, o Nymphæ Craterides, ite sub undas
> Ite, recurvato variata corallia trunco
> Vellite muscosis e rupibus, et mihi conchas
> Ferte, Deæ pelagi, et pingui conchylia succo."
> *N. Parthenii Giannettasi*, Ecl. 1.

No. 25. JANUARY 1940.

I.—*The Microfossils of the Upper Carodocian Phosphate Deposits of Montgomeryshire, North Wales.* By Professor H. P. Lewis.

[Plates I.–IV.]

Introduction.

The purpose of this paper is to record and describe one of the richest assemblages of microfossils so far recognized in the Lower Palæozoic rocks of Britain. These fossils consist mainly of the spicules of Silicispongiæ, but micro-organisms and a few fragments of shelly fossils (mainly Bryozoa and brachiopods) are also present. Calcispongiæ appear to be absent, the spicules belonging exclusively to the Hexactinellida and the Desmospongiæ. The micro-organisms include members of the Hystrichosphæridæ, O. Wetzel, a group of uncertain systematic position, but possibly flagellates. Certain of the spicular forms, the Hystrichosphæridæ and the associated Chitinozoa, Eisenack, have not previously been recorded from the Palæozoic rocks of Britain.

DISTRIBUTION OF THE PHOSPHATIC DEPOSITS.

The deposits which have yielded these fossils occur in the uppermost beds of the Caradocian of Montgomeryshire, and they have been known since 1863. They were first mentioned by Voelcker in 1864 *, and more fully described by Davies in 1867 and 1875 †.

According to Davies, "the bed varies in thickness from 10 to 15 inches. It is black from the graphite it contains and its appearance is that of a number of concretions which range in size from that of an egg to that of a full-sized cocoa-nut, closely packed and even running into each other and cemented together by a black matrix. The concretions have often a polished appearance, which is also due to the presence of graphite , and frequently along the course of the bed the phosphorite is charged with concretions and crystals of sulphide of iron. Near the outcrop of the bed this becomes oxidised and the deposit changes its black for a rusty appearance. The concretions . . . . contain the most phosphate of lime, usually 64 per cent; but the matrix also contains a portion. There is but one bed of phosphorite, and it is very persistent. Sometimes, however, the bed divides, mostly into two, but sometimes into three beds. The dividing substance is the thin phosphatic limestone " †.

The phosphate-band has been traced from Llanfyllin, through Pen-y-garnedd and Cwm-gwynen to the Berwyn Mine between Llangynog and Bala, and even further west, into the Aran Range, according to D. C. Davies, who estimates that it is probably continuous under an area of about 150 square miles. It occurs southwards of Llanfyllin in the Meifod area.

Professor King refers to the deposit at Pen-y-garnedd as an 18-inch bed of phosphatic material at the base of some 45 feet of jet-black soft shales. These Pen-y-garnedd Black Shales contain graptolites which, according to King, belong to the *Diplograptis pristis* zone of Sweden, and they therefore represent the highest part of the

---

* British Assoc. Rep., Birmingham, 1864.

† Davies, D. C., Geol. Mag. 1867, p. 251; Quart. J. Geol. Soc. 1875, p. 357.

Pleurograptis linearis zone, or highest Caradocian rocks of Britain *.

The section of the Pen-y-garnedd Shales at Pen-y-garnedd, as given by King in the Oswestry Memoir, p. 42, is as follows :—

	ft.	in.
(*e*) Black shales with graptolites and three or four bands of phosphatic limestone in the lowest 8 feet	44	0
(*d*) Phosphate-bed ; top with rusty stain.....	1	3
(*c*) Phosphatic limestone ; phosphate nodules most numerous near top	1	6
(*b*) Dirty calcareous beds	1	0
(*a*) Buff and grey shale	1	0

Pen-y-garnedd Limestone. (=Bala Limestone. D. C. Davies.)

The phosphate-band at Pen-y-garnedd is that which has yielded the bulk of the material investigated by the writer. This band includes bed (*d*) and the upper three inches of bed (*c*) of the above section. The nodules in this band are unevenly distributed in the shale, but, in places, as at the base, they tend to occur packed together in layers or lenses up to 1 or 2 inches thick.

Some of the nodules which have been collected from the old phosphate-workings at the Berwyn Mine and from the old phosphate- and barytes-workings at Cwm-gwynen contain a few microfossils similar to those obtained at Pen-y-garnedd. So far such fossils have not been identified in the phosphatic nodules of Bala age in the Dinas Mawddwy and Llanymawddwy country described by Professor Pugh †.

Towards the south of Llanfyllin, in the Meifod district, Professor King has shown that " the phosphate-bed is formed of irregular nodules of black cindery-looking rock, often highly pyritous ; the pyrites occurs, either in the form of partly pyritized oolitic grains or in irregular granules." He states that, " No signs of fossils have been detected in the phosphate-bed, other than some traces of minute bryozoa visible in rock-slices" [*].

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* King, W. B. R., Q. J. G. S. 1923, p. 492 ; Mem. Geol. Survey Great Brit., Explanation of Sheet 137 (Oswestry), 1929, p. 42.

† Pugh, W. J., Q. J. G. S. vol. lxxxiv. p. 355 ; *ibid.* vol. lxxxv. 1929, p. 255.

North-eastwards of Llanfyllin, in the district mapped and described recently by Whittington, no reference is made by him to the occurrence of the phosphate-bed, although he regards it as probable that the Pen-y-garnedd Black Shale was originally a continuous deposit over the whole of that area [†].

PREVIOUS WORK ON THE CONSTITUTION OF THE PHOSPHATE.

Until recently most of the detailed work on the phosphatic deposits of this area seems to have been confined to chemical analysis. In 1932, however, M. L. Cayeux published a note on a specimen of the phosphate "from above the Bala Limestone of Montgomeryshire" sent to him by Sir John Flett [‡]. In this note he describes the material as seen in thin section, and claims that the abundant spicules belong to calcareous sponges. He states, in his description of the material:

"Sa constitution revêt une extrême simplicité. Qu'on imagine un fond de phosphate gris, chargé de carbone, emprisonnant de petits spicules de Calcisponges silicifiés, au nombre de plusieurs centaines dans chaque section, et l'on aura une idée très exacte du milieu. Les minéraux détritiques manquent complètement dans les coupes, ainsi d'ailleurs que les organismes, autres que les représentants de Spongiaires."

"Les spicules monoaxes l'emportent de beaucoup. Il en est parmi qui sont pourvus de renflements très caractéristiques, soit vers le milieu, soit non loin d'une extrémité. Des spicules triradiés, dit sagittaux, sont non moins typiques. Tous sont quartzifiés . . . ."

While M. Cayeux is evidently convinced that the spicules are those of calcareous sponges he gives no morphological evidence in support of his contention. Further, in regard to the silicification he draws the following conclusions: "La silicification, à grande échelle,

---

[*] King, W. B. R., Q. J. G. S. vol. lxxxiv. 1928, p. 675.

[†] Whittington, H. B., Q. J. G. S. vol. xciv. 1938, p. 432.

[‡] Cayeux, L., Comptes Rendus Acad. Sci. Paris, cxcv. 1932, pp. 1188–1190.

des spicules de Calcisponges dans un milieu phosphaté, fait supposer que l'épigénie du calcaire des spicules s'est faite avant la phosphatisation du dépôt. Etant donné ce que l'on soit des affinités de l'acide phosphorique pour le carbonate de chaux, on peut affirmer que les spicules auraient été phosphatisés, s'ils n'avaient été quartzifiés, avant l'introduction du phosphate dans le sédiment."

It will be shown in this paper that the spicules in the phosphate belong definitely to the Silicispongiæ, including the Hexactinellida and the Desmospongiæ, no Calcispongiæ having been recognized. M. Cayeux's "triradiés" are no doubt hexactines, and the question of silicification of the spicules before their incorporation in the phosphate does not arise.

THE CONDITIONS UNDER WHICH THE PHOSPHATE WAS DEPOSITED.

In his note, to which reference has just been made, M. Cayeux considers the phosphate of Montgomeryshire to be unique in character. Actually, however, several comparable deposits exist and have been described, for instance, from the Carboniferous, Jurassic, and Tertiary of Europe. Davies * suggested that the graphite content may have been derived from seaweeds, and he regarded "the phosphate-bed as the remains of a laminarian zone of sea-life," but he considered the phosphate itself to be of animal origin. The present investigation shows that the carbonized tests of the Hystrichosphærids and of the Chitinozoa must contribute, perhaps largely, to the carbon present in the deposit.

King, dealing with the conditions of deposition of the Pen-y-Garnedd Shales, suggests, on the evidence of the abnormal characters of the fauna, including dwarfing, the lithology of the shales and the presence of the phosphate-band, that "the beds were formed in a shallow sea, free from much sediment, yet unfavourable for the normal life of the times, a state which may be attributed to lagoon conditions" †. The type of lagoon postulated here is the marginal lagoon described by Dixon ‡, and

* Davies, D. C., *op. cit.* 1875, p. 362.

† King, W. B. R., Q. J. G. S. 1923, p. 494.

‡ Dixon, E. E. L., Q. J. G. S. vol. lxvii. 1912, p. 511.

is, presumably, similar also to the "*Erythrospongia* lagoon," with abundant Hexactinellid sponge remains, described by Hudson in the Carboniferous of the north of England*.

If we consider the bathymetrical distribution of the recent Hexactinellid sponges, which, in their spicular framework, differ very little from their Palæozoic forerunners, we find that they occur, in general, at depths greater than 100 fathoms. The Lithistida are also essentially fairly deep water forms, and are most abundant between 100 and 150 fathoms. The Monactinellida range from shallow water to great depths. Bearing in mind the presence of the Hystrichosphærids in both the Chalk and the Pen-y-garnedd phosphate-bed in association with representatives of the groups of benthonic sponges just alluded to, a striking correspondence is observable between the microfossils of the two deposits. The evidence gained by an estimate of the relative abundance of fossil remains belonging to the different groups of sponges in the Chalk has been used to postulate the probable depth of the Chalk sea, viz., between 100 and 200 fathoms. The marginal lagoons of Dixon, King, and Hudson are probably considered in general to be of less depth than this; and, in fact, several instances are known where Hexactinellid sponges occur in deposits of which the shallow water origin is almost certain, for instance, in the Inferior Oolite † and in the coarse transgressive deposits of Cretaceous age near Dresden ‡. So the possibility that the Hexactinellida were capable of occupying higher bathymetrical zones in past times than they are at the present day may afford an explanation of their presence, and sometimes their abundance and excellent preservation, in what from other evidence appear to be shallow water deposits. In the present instance the unbroken character of great numbers of the fragile spicules and the tendency towards an oolitic or pisolitic development of the nodules, which can be sometimes detected in rock-slices, tend to show that the bottom conditions were almost stagnant, or that the seabed was at most disturbed by gentle currents only, although several of the nodules contain angular quartz grains of fine sand and silt grade.

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* Hudson, R. G. S., Proc. Yorks. Geol. Soc. vol. xxi. 1929, p. 181.
† See Woods, H., 'Palæontology,' 7th edit. 1937, p. 50.
‡ O'Connell, M., Bull. Amer. Mus. Nat. Hist. vol. li. 1919, pp. 1–261.

A recent occurrence of phosphate formation off southern California, described in abstract by Dietz and Emery *, seems in many respects to parallel that under consideration. The authors state, " On the tops of submarine banks phosphate was the type of rock most frequently encountered and it was also common in dredging from steep slopes." The evidence suggests that these phosphates are being deposited at the present time. " Phosphate liberated from the remains of marine animals probably serves as a source." Collophane is the principal mineral and is present as a pure deposit or as a cement for unconsolidated rock-fragments, phosphatic oolites, glauconite, and foraminiferal sand. Organic remains enclosed in the phosphate include fish and mammal bones, sponge spicules, foraminifera, and diatoms. The environments are characterized by the absence of sediments except for some glauconitic and foraminiferal sand.

It appears, therefore, that the phosphate-band of Montgomeryshire was deposited under conditions similar to those now obtaining off the southern coast of California, but in a somewhat enclosed sea of moderate depth and sufficiently deep to allow for the growth of sponge-types that at the present day are found from moderate (50 fathoms) to great depths. Bottom conditions were locally stagnant and the associated normal pelitic sedimentation was reduced to a minimum.

THE REPLACEMENT OF THE SILICA OF THE SPICULES BY PHOSPHATE.

The study of thin slices of the phosphatic material has revealed some interesting stages in the alteration of the spicules. In many instances the boundaries between the outer surfaces of the siliceous spicules and the enclosing phosphate matrix are fairly sharply defined, and the outer surfaces of such spicules which have been isolated from the matrix are usually moderately smooth. Cayeux refers to instances where the silica of the spicules invades the matrix, but this may be explained either as being due to certain types of spicule having surface

---

* Dietz, R. S., and K. O. Emery, Bull. Geol. Soc. Amer. vol. xlix. 1938, p. 1878.

spines or knobs which project into the matrix or by the replacement of the silica of the spicule by the phosphate producing an irregular junction between the two minerals. Phosphate also is often found to form an inner zone, apparently representing an infilling of the spicular canal, within the spicule (see Pl. II. fig. 31). Frequently this inner zone (representing the original canal) is wide in comparison with the thickness of the spicule, occupying more than half of its width; in other cases the canal is much narrower. In some spicules the boundary of this inner zone of phosphate with the enclosing wall of silica is quite definite, and little or no replacement seems to have taken place. In other instances, however, phosphatization of the silica has extended outwards from the canal, and all stages can be traced up to the complete replacement of the silica as far as the outer surface of the spicule.

The spicular canal in some spicules is occupied, wholly or in part, by iron-pyrites, but more frequently hæmatite, in the form of rounded or elongate globules of minute size and blood-red colour, occurs in its place. Occasionally these globules or granules occur in lines along the axes of the spicular canals, but they are also found united into compact rods (see Pl. II. fig. 32). Where hæmatite occurs alone as the infilling material the spicular canal is usually narrow, but often the hæmatite is developed within the phosphatic infilling of the canal, which then is usually wide. When all the silica of a spicule has been replaced by phosphate the line (or lines) of granules of hæmatite (or of pyrites) is all that remains to indicate the former presence of a spicule. Globules or granules of hæmatite sometimes occur scattered throughout the silica of a spicule, and are not confined to the canal.

In some of the hexactinellid spicules that have been isolated it is evident that fracture and dislocation of the infilling material of the spicular canal has taken place. This seems to indicate internal alterations and movement, probably accompanying the more or less general "quartzification" of the silica of the spicules (see text-fig. 2).

It would appear that the siliceous spicules had not suffered any marked change prior to their incorporation in the phosphate, for the spicular canals still remained open to admit the phosphatic material.

DESCRIPTION OF THE MICROFOSSILS.

The following descriptions are based on the study of thin sections of the phosphate nodules together with the examination of large numbers of spicules and a smaller number of other fossils which have been separated from the matrix by treatment with acid, washing, and hand-sorting. Very few spicules of Lower Palæozoic age have been so far described in this isolated state, and the majority of the descriptions of these early spicules have been based on their appearance in thin section, an appearance that is at times wholly misleading.

The forms of the sponge-bodies whose remains occur in the phosphate cannot be elucidated except possibly in one instance. It was thought that the nodules themselves might represent the sponge-body in some instances, but, so far as investigations at present show, this does not appear to be the case. The nodules at times consist in part of aggregations of a pisolitic character; they contain sand, a few fragments of Bryozoa, and other shell material, and they cannot represent single sponges as one and the same nodule yields hexactinellid, lithistid, and monactinellid remains in association with one another.

In nearly every case, therefore, identification depends upon the form manifested by the individual spicules, and often comparison can be made only to similar forms which have been given specific names. Such names obviously have no validity to represent anything more than "form-species." Where sections of spicules in a rock-slice provide the only evidence available for identification it is questionable whether in the majority of cases, except in the most favourable circumstances, accurate reference can be made to the genus, or even to the order or class of sponges to which the spicule belongs.

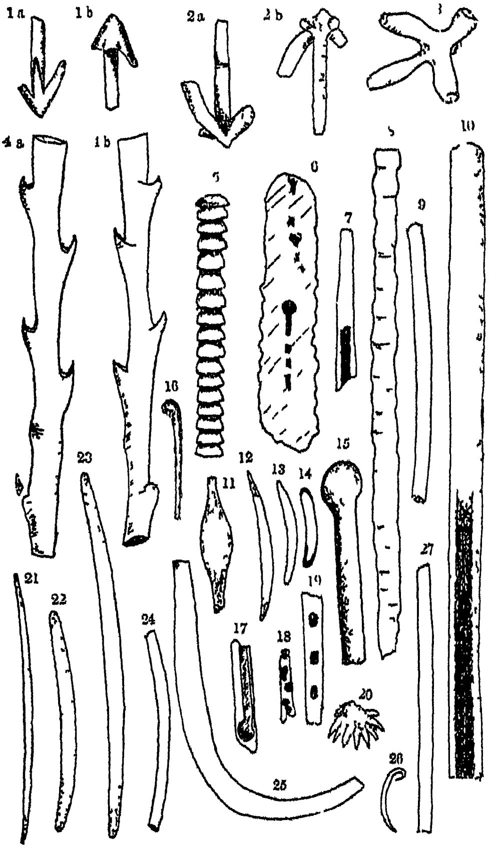
PORIFERA.

MONACTINELLIDA (?).

ATRACTOSELLA Hinde.

Genotype: *Atractosella siluriensis* Hinde, 1887, British Fossil Sponges, Pal. Soc. p. 123, pl. i. figs. 6, 6 *a*–6 *d*. Wenlock, Shropshire.

Text-figure 1 (1–27).



1 *a*, 1 *b*. *Pyritonema* cf. *subulare* Roem., pronged anchoring spicule, slide 50, ×50. 2 *a*, 2 *b*. *P*. of *subulare*, hexacton with recurved rays, ×50. 3. *P*. *subulare*, hexacton, ×50. 4 *a*, 4 *b*. *P*. *minuta* Pulfrey, anchoring spicules with surface spines, ×50. 5. *P*. cf. *fasciculus* McCoy, anchoring rhabd, ×50. 7. Fragment of rhabd or ray, ×15. 6, 8. *P*. *fasciculus* McCoy, anchoring rhabds, ×15. 9, 24, 27. *Pyritonema* sp., curved and straight rhabds, ×50. 10. *Pyritonema subulare*, rhabd with smooth surface and wide canal, ×15. 11. *Atractosella* cf. *siluriensis* Hinde, spindle-shaped spicule, ×50. 12–14, 21, 22, 23. Monaxon spicules, ×50. 15. *Axinella* cf. *paxillus* Hinde, ×50. 16 *Axinella* cf. *vetusta* Hinde, ×47. 17. Open spicule, ×15. 18, 19. Bored spicules, ×15. 20. *Pyritonema minuta*, umbel of an amphidisc, view of convex surface, ×26. 21. Monaxon, ×15. 25, 26. *Cladorhiza* sp., sigmata. ×50.

Sponge-form unknown. Generic name refers to detached spindle-shaped spicules with blunted ends.

Atractosella cf. *siluriensis* Hinde.
(Text-fig. 1 (11).)

This form is represented at Pen-y-garnedd by detached spicules of rare occurrence, circular in cross-section, spindle-shaped, with the central portion about 0·08 mm. thick. Longitudinal axis straight, extremities broken or blunted, surface fairly smooth, length 0·35 mm.

The Ordovician form is smaller and more symmetrical in outline than *A. siluriensis*, which Hinde recorded from the Wenlock beds near Craven Arms.

HAPLISTION Young & Young.

Genotype: *Haplistion armstrongi* Young & Young, Annals & Mag. Nat. Hist. ser. 4, vol. xx. p. 428, pl. xv. figs. 31–37, 1877. Carboniferous, Ayrshire.

Sponge-form small, ovoid, spheroidal or discoidal. Consists of solid, reticulate, anastomosing fibres. The fibres are composed of minute, straight or curved acerate spicules, interlacing with each other.

Haplistion davisi, sp. n.
(Pl. I. figs. 1 & 2.)

The complete form is not known. The species is based on broken fragments of the anastomosing fibres, which vary between 0·75 mm. and 1·3 mm. in thickness. These fibres formed part of a network similar to that of *H. armstrongi*. The unbranched portions of the fibres are from about 3 mm. to 4·35 mm. long. Each of the conical projections appears to have a terminal opening (thus simulating some recent species of *Reniera*). The surface of the fibres is covered with minute spicules which usually show slight curvature of the longitudinal axis. They are about 0·3 mm. in length and 0·05 mm. in maximum thickness, but taper towards the ends. In addition a few straight and slightly longer spicules occur.

The substance of the sponge-fibres beneath the covering of spicules is composed of an intricate intergrowth of silica and pyrite penetrated, irregularly, by what may be canals.

Compared to the Carboniferous species as described by the Youngs and Hinde * the spicules are of about the same size, but the fibres seem, on the whole, to have a greater thickness than in *H. vermiculare* (Carter) and they are much thicker than those of *H. armstrongi*. Also the branching of the fibres is much looser than in either of the Carboniferous species.

Holotype: the specimen of which a bifurcate fibre is figured on Pl. I. fig. 1. No. 30. Pen-y-garnedd Coll., U. C. Wales, Department of Geology. Upper Caradocian phosphate-bed, Pen-y-garnedd, Montgomeryshire.

Reniera (?) spp.

In addition to the minute monaxons coating the surface of *Haplistion davisi* and occurring loose in the residue, similar but larger spicules of lengths varying from 0·4 mm. to 2·3 mm. and with thicknesses from 0·03 mm. to 0·05 mm. are very abundant. They are usually gently curved and taper evenly to acute or rounded terminations. The ratio of length to greatest thickness varies considerably (see Pl. I. & text-fig. 1).

It has been customary to refer spicules of this type to the monactinellid genus *Reniera* O. Schmidt or to the tetractinellid genus *Geodites* Carter. When, however, the wide distribution of monaxon spicules amongst all classes of modern sponges is taken into consideration it will be recognized that it is impossible to determine the true position of these forms when they occur in an isolated state.

Straight monaxons up to about 1 mm. in length, tapering towards both ends, which are rounded (Pl. I. fig. 7), correspond in form to spicules of Carboniferous age which Hinde assigned to species of *Reniera* † (e. g., *R. zitteli* Pocta). Very minute, slightly curved forms, only 0·2 mm. in length, cylindrical and having rounded ends, are indistinguishable from spicules of *Reniera gracilis* Hinde, which is recorded from the Upper Greensand, the Lower Greensand, and the Carboniferous Limestone. Dr. Hudson includes all such monaxon forms among the surprisingly great variety of spicules which he suggests belong to his Carboniferous lyssacine species *Erythraspongia lithodes* *.

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* Hinde, G. J., Brit. Foss. Sponges, Palæont. Soc. Mem. 1888, pp. 146–148.

† Hinde, G. J., *op. cit.* pp. 141–144, pl. ii. fig. 8.

Cladorhiza (?) spp.
(Pl. I. fig. 8; text-fig. 1 (25, 26).)

Some confirmation of the presence of Monactinellid sponges in the deposit is suggested by the presence of hooked spicules of fairly large size. Among recent sponges such spicules appear to be more characteristic of the Monactinellida than they are of the other groups. They are found, for instance, in the Desmacidonidæ classed as sigmata among the microscleres. This classification includes some spicules of moderate size; the sigmata in the recent species *Cladorhiza moruliformis* Ridley and Dendy, for example, reach 0·35 mm. in length †. I refer, therefore, tentatively, the hooked species in the phosphate to *Cladorhiza* M. Sars (1872).

The minute hooked forms which occur at Pen-y-garnedd may be regarded with little doubt as sigmata or sigmaspires. They are 0·2 mm. or less in length, and possess a delicate recurved hook at one end. This fragile hooked portion is easily broken off, and then the spicule is indistinguishable from an ordinary gently curved microxea (see text-fig. 1 (26)).

The larger hooked spicules often exceed 0·8 mm. in length, and their size and shape suggest that they are probably megascleres. Such forms appear to be rare as fossils, at all events in Palæozoic rocks. Hinde figures two hooked forms of approximately similar size from the Upper Chalk, and refers them to Carter's tetractinellid genus *Ophiraphidites* ‡, but without showing any sound reason for doing so. The larger hooked forms from the Caradocian rocks are usually broken, but when they are complete they taper to both ends and are usually L-shaped, but U-shaped forms occur (see Pl. I. fig. 8). So far as I am aware, this is the first record of such spicules from the Lower Palæozoic rocks.

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* Hudson, R. G. S., Proc. Yorks. Geol. Soc. vol. xxi. pp. 186 & 188, 1929.

† 'Challenger' Report, Monaxonida, 1887, p. 91.

‡ Hinde, G. J., 'Fossil Sponge Spicules from the Upper Chalk.' Munich, 1880, pp. 28–29, pl. i.

AXINELLA O. Schmidt.

Axinella cf. *vetusta* Hinde.
(Pl. I. fig. 4 (pars); text-fig. 1 (16).)

Axinella vetusta Hinde, Brit. Foss. Sponges, 1888, p. 145, pl. iv. fig. 6.

Axinella is a living sponge and is found in the Mediterranean. Hinde has referred certain detached spicules to this genus, and the earliest of these occur in the Carboniferous Limestone of Clitheroe and Scotland, and have been named *Axinella vetusta*. Spicules of smaller size but of similar shape occur in the phosphate at Pen-y-garnedd. The longitudinal axis is slightly curved, the spicule tapers to a point at one end, the other end being rounded and either as thick as the middle portion or even somewhat inflated. The length is about 0·34 mm. and the maximum thickness 0·04 mm. A longitudinal axial canal can usually be seen by transmitted light, and such is the case with may of the monaxons here described. The infilling of the canals consists as a rule of hæmatite, and granules of this mineral are to be found scattered throughout some of the spicules.

Axinella cf. *paxillus* Hinde.
(Pl. I. fig. 9; text-fig. 1 (15).)

Axinella paxillus Hinde, Brit. Foss. Sponges, Pal. Soc. 1888, pp. 145–6, pl. ix. fig. 10.

Isolated, straight, cylindrical spicules, with a smooth surface and one end conspicuously inflated into a rounded knob, appear to be the equivalent to detached spicules of Carboniferous age from Clitheroe which Hinde named *Axinellus paxillus*. So far I have not found a complete spicule at Pen-y-garnedd, the, presumably, pointed end having been broken off in every instance.

HEXACTINELLIDA.

Hyalonematidæ.

PYRITONEMA M'Coy, emend. Rauff.

The name *Pyritonema* was given by M'Coy in 1850 * to bundles of rhabds which are now regarded as the basal tufts of various genera of the Hyalonematidæ. Zittel proposed the name *Hyalostelia* in 1878 [*] for spicules referred by Young & Young to *Hyalonema smithii* [†]. Hinde, in 1883 [‡], referred *Pyritonema* M'Coy to *Hyalostelia* Zittel (as emended by Hinde to include only the anchoring and hexactinellid body spicules of *H. smithii* Young & Young), on the ground that M'Coy had founded *Pyritonema* exclusively on the bundles of anchoring spicules. In 1893 Rauff [§] proposed the use of both names as convenient terms, *Pyritonema* M'Coy for the earlier Palæozoic forms and *Hyalostelia* for the later ones. Recent workers like Ruedemann [||] and Pulfrey [¶] follow Rauff, and include in the genus *Pyritonema* M'Coy, as emended by Rauff, simple hexactinellid spicules usually with one axis elongated, spicules with one or more rays inflated, spined, or knobbed, and straight or slightly curved spicules forming basal tufts and having surfaces which are smooth, rugose, or spined.

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* M'Coy, F., Ann. & Mag. Nat. Hist. ser. 2, vol. vi. p. 273.

The name " *Hyalostellia* " (sic) Zittel, is used by Weller in a recent paper [**] to include certain hexactinellid spicules of Carboniferous age described by him and which do not appear to depart from the diagnosis given above for spicules of *Pyritonema* M'Coy.

Pyritonema subulare (F. Roem.), emend. Rauff. (Pl. I. figs. 14–17; Pl. II. figs. 3–10, 28; text-fig. 1; (1–3, 9, 10, 27), text-fig. 2 (8–13, 16, 17).)

Acestra subularis F. Roemer, 1861, Foss. Fauna Sil.-Diluv. Geschiebe Sadewitz, p. 55, pl. vii. figs. 7 *a* & 7 *b*.
Hyalonema girvanense Nicholson & Etheridge, jun., Mon. Sil. Girvan Dist. Ayrshire, pt. i. 1880, p. 239, pl. xix. figs. 1 & 1 *b*.
Hyalostelia Smithii Hinde (non Young & Young), Brit. Foss. Sponges, 1888, p. 118, pl. i. figs. 4 & 4 *a*.
Pyritonema subulare (F. Roemer) Rauff, "Palæospongiologie," Palæontographica, 1894, vol. xl. p. 261, pl. v. figs. 1, 6–20, pl. vi. figs. 1–6.

Anchoring Spicules.—As in the forms of this species described by Rauff the surfaces of the straight rhabds are smooth and there is great variability in their dimensions. Even the longest of these spicules are incomplete,

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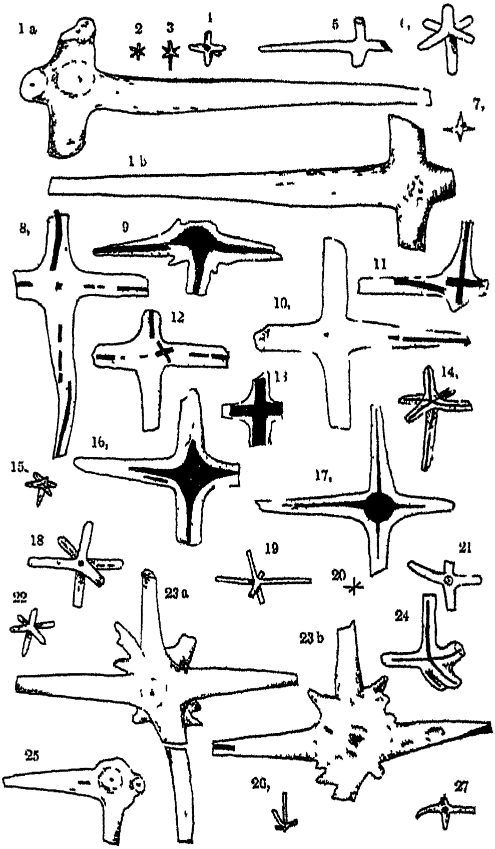
[*] Zittel, K. A., 'Handbuch der Palæontologie,' 1878, Bd. i. II. Lief.
[†] Young & Young, " *Acanthospongia* " *smithi*, Cat. West. Scot. Foss. p. 38.
[‡] Hinde, G. J., Cat. Foss. Sponges B.M. pp. 150–153.
[§] Rauff, H., "Palæospongiologie," Palæontographica, vol. xl. p. 257 ff.
[||] Ruedemann, R., New York St. Mus. Bull. 1925, pt. 2, p. 36–8.
[¶] Pulfrey, W., Ann. & Mag. Nat. Hist. ser. 10, vol. ii. p. 73, 1933.
[**] Weller, J. M., Journ. of Palæontology, iv. p. 242, 1930.

Text-fig. 2 (1–27).



1 *a*, 1 *b*. *Plectoderma* cf. *scitulum* Hinde, "pentacton," two views. 2, 3, 4, 7, 15, 22. *Pyritonema minuta* Pulfrey, microscleres. 5, 6, 14, 18, 21, 27. *P. minuta* Pulfrey, hexactons. 19, 20. *P. delicata* Pulfrey, hexactons. 8–13, 16, 17, 21, 23–26. *P. subulare* Roem., hexactons. Several of the hexactons are drawn as viewed by transmitted light, and, owing to the opacity of the material filling the spicular canals, they show variations in the shape of the nodal confluence of these canals, in the width of the canal relative to the diameter of the ray, and, in some instances, in the amount of disturbance and movement of the infilling material in relation to the original axial positions which it occupied within the rays previous to the "quartzification" of the spicules. 23 *a*, 23 *b*. Two views of a spicule having some resemblance to a "heteractinellid" form (cf. *Tholiasterella* spp. Hinde), but more probably produced by the fusion of two spicules of *Pyritonema subulare* Roem. All figures × 15 approx.

but the fragments attain lengths of more than 5 mm. and a thickness of 0·3 mm.; thus they approximate in size to the smaller forms belonging to *P. subulare* and the Carboniferous species *P. smithii.* Similar straight or slightly curved rods possessing a fairly uniform thickness of 0·05 mm. are also referred to *P. subulare* (see Pl. I.).

One spicule has been isolated which shows a smooth broken shaft with four recurved rays at its distal end. The rays are welded together at their proximal ends, but are separate and form sharp prongs at their distal extremities (see figs. 1 *a* & 1 *b* of text-fig. 1). This form is about 0·3 mm. in length, and except for its much smaller size is quite similar to an anchoring spicule of *P.* (*Hyalostelia*) *smithii* which Hinde figures from the Carboniferous of Ayrshire (Brit. Foss. Sponges, pl. vi. fig. 2 *f*). This appears to be the first record of a comparable form from the Lower Palæozoic rocks.

Hexactons.—The hexacton spicules referred here to *P. subulare* are moderately large forms showing an occasional unbroken or almost entire ray up to 1 mm. in length and tapering from 0·2 mm. to 0·1 mm. in thickness. The terminations where the rays are entire are rounded, and the rays may be straight or slightly flexed. In some spicules a feature which is manifest in some of Rauff's figures of the hexactons of *P. subulare* is apparent. In these the rays near their junctions at the node appear to be constricted owing to the normal tapering giving place suddenly to inflation in thickness in the vicinity of the node (see text-fig. 1 (3)).

Some of the hexactons show a reduction in length of one of the rays and in others abnormal curvature and even recurvature of one or more of the rays is to be seen. One spicule shows one ray reduced to a mere tubercle and at least two of the rays adjacent to it curved away from it so strongly that the spicule might be regarded as illustrating, in consequence, a stage intermediate between a normal hexacton and a pronged anchoring spicule * (see text-fig. 1 (2)).

Open Spicules.—Small spicules and fragments of spicules with smooth surfaces but open throughout their length may find a place here. They are all straight forms and are usually short with rounded ends. They appear to be in the unclosed condition observable in the spicules of some recent sponges (text-fig. 1).

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* *Cf.* Hinde, G. J., Foss. Sponge Spicules. Munich, 1880, pl. i. fig. 32.

Bored Spicules.—Some smooth, straight spicular fragments have been observed which are pierced by minute holes. The holes seem to have been drilled by some boring organism, possibly a sponge (text-fig. 1 (18, 19)).

Pyritonema fasciculus M'Coy (non Rauff).
(Pl. I. figs. 10, 11, 12; text-fig. 1 (5, 6, 8).)

Pyritonema fasciculus M'Coy, 1850, Ann. & Mag. Nat. Hist. ser. 2, vol. vi. p. 273.

Pyritonema fasciculus M'Coy, 1855, Brit. Palæozoic Fossils, p. 10, pl. i. B, figs. 13, 13 *a*, & 13 *b*.

Hyalostelia fasciculus (M'Coy) Hinde, 1886, Geol. Mag. vol. iii. p. 337, fig. 1.

Hyalostelia fasciculus (M'Coy), Hinde, 1888, Brit. Foss. Sponges, pp. 110–112, pl. i. fig. 3.

Hyalostelia gracilis Hinde (pars), 1888, ibid. pl. i. figs. 5 *e* & (?) fig. 5 *f*.

This species is known by its anchoring spicules only, which have been found forming root-tufts of considerable length. In the present instance fragmentary isolated rhabds alone occur. They are straight, circular in cross-section, and up to about 4·0 mm. in length and 0·2 mm. in diameter. The spicules are distinguished by having rather irregularly spaced transverse corrugations, ridges, or "fringes" on the surface. These correspond to the ornamentation described by M'Coy and by Hinde as typical of M'Coy's holotype in the Sedgwick Museum, Cambridge, which was obtained from the "Llandeilo" rocks near Llandilo.

As noted by Hinde, in some of the spicules the corrugations adorn a portion only of the surface, a great portion of the spicule exhibiting a smooth surface, so that it is possible for fragments of considerable length without any corrugations to occur. Although in this and other respects Hinde's description of the ornament is fully applicable to the Pen-y-garnedd forms, the latter are much smaller than in Hinde's figured specimens of *Hyalostelia fasciculus*, and show a striking resemblance to his fig. 5 *e* of pl. i. 'British Fossil Sponges,' 1888, which he terms *Hyalostelia gracilis*, but which, in my opinion, should be referred to *P. fasciculus*, M'Coy. Our rhabds are somewhat larger than Hinde's figures of those of *H. gracilis*, which are of Wenlock age.

Fragments of a straight form of much smaller dimensions occur at Pen-y-garnedd; they are up to 1 mm. long and have a maximum thickness of 0·1 mm. These spicules have a regular surface ornamentation of equally spaced and very definite annular ridges, which give to the rhabd a screw-like appearance (see pl. i. fig. 12, and text-fig. 1 (5)). For the present this hitherto unrecorded form may be regarded as a variant of *Pyritonema fasciculus.*

Pyritonema minuta Pulfrey. (Pl. I. fig. 13; Pl. II. figs. 11–15, 17, 20–22, 24–27, 29, 30; text-figs. 1 (4 *a*. 4 *b*, 20) & 2 (2–7, 14, 15, 18, 21, 22).)

Pyritonema minuta Pulfrey, 1933, Ann. & Mag. Nat. Hist. ser. 10, vol. xi. pp. 73–74, text-fig. 2 (1–9, 18, 19), pl. ii. figs. 1–3.

Pyritonema fasciculus (pars) Rauff, 1894, Palæontographica, vol. xl. pp. 259–61, pl. iv. figs. 7 & 9.

In 1894 (*op. cit.*) Rauff described and figured anchoring and hexacton spicules which he referred to *Pyritonema fasciculus* M'Coy. Some of Rauff's figures of the anchoring spicules, which were obtained from the *Leptæna* Limestone of Dalarne, do not correspond to the descriptions given by M'Coy and Hinde of specimens of this species from British Upper Cambrian and Ordovician rocks. As it would appear that Rauff's reference of the Dalarne anchoring spicules to *Pyritonema fasciculus* M'Coy is incorrect, it follows that there is no evidence for assigning the hexactons which he associated with the rhabds to that species, particularly as no hexactons of *P. fasciculus* M'Coy are known with certainty. Pulfrey (*op. cit.*) has recently erected the species *Pyritonema minuta* to include anchoring and hexacton spicules from several Lower Palæozoic horizons in North Wales, and he draws attention to the close resemblance between his species and the *P.* "*fasciculus*" of Rauff. I consider that Rauff's figures (7 & 9 of pl. iv.) may be regarded as equivalent to *P. minuta* Pulfrey, Rauff's fig. 6 (pl. iv.) may possibly be *P. fasciculus* M'Coy, his fig. 8 (pl. iv.) may represent *P. delicata* Pulfrey, while it is not possible from the fig. 5 of the same plate to decide the species of the specimen illustrated.

Megascleres.—Anchoring Spicules (Pl. I. fig. 13; text-fig. 1 (4 *a*, 4 *b*). Several straight fragments up to 1 mm.

in length and with a width of 0·1 mm. have been isolated from the phosphate of Pen-y-garnedd. From their surface sharply pointed and slightly recurved spines project at somewhat irregular intervals. These are more pronounced than they are in the rhabd shown in section by Pulfrey (text-fig. 2 (9)), and which he doubtfully refers to *P. minuta*. The spicules, however, can be identified with certainty in size and ornament with Rauff's figure of a longitudinal section of an anchoring rhabd of his *P. "fasciculus"* (pl. iv. fig. 7). A very similar arrangement of spines is to be seen on the anchoring spicules of several living hexactinellids, as, for instance, *Euplectella crassistellata* F. E. Schulze and *Holascus fibulatus* F. E. S. (It is possible, judging by relative size and a comparison with recent anchoring spicules, that the forms with four recurved rays placed above in *P. subulare* may actually be the end portions of anchoring rhabds of *P. minuta*.)

Hexactons.—The majority of the complete hexactons found at Pen-y-garnedd are probably parenchymalia. They possess rays which are from 0·07 to 0·1 mm. in thickness and about 0·5 mm. in length. The rays tend to leave the node at or nearly at right angles to adjacent rays, and then remain straight or are curved only slightly. The ends of the rays, when unbroken, are usually rounded.

Unfortunately Pulfrey's (and Rauff's) figures of the hexacton spicules of *P. minuta* are from rock-slices, so that comparison with them is difficult, but from a general correspondence in the attitude of the rays and in dimensions it appears that the triaxial spicules here referred to belong to *P. minuta*.

Microscleres.—One feature of the spicule assemblage at Pen-y-garnedd is the abundance and excellent preservation of the microscleres. So far as I am aware a Lower Palæozoic microsclere has been recorded by Pulfrey alone, and he referred this to *P. minuta*. For present convenience therefore I refer the majority of the minute spicules, obtained from the phosphate which are probably "flesh-spicules" or microscleres, to *Pyritonema minuta*.

Hexactons.—Abundant very minute but often entire hexactons have been isolated. They vary in size, and the rays of an individual spicule may be of equal length or one ray may be longer and the ray on the same axis and opposite to it shorter than any one of the four rays of uniform length which occur in the plane normal to this axis. In the majority of the spicules the rays are straight, of equal size, and about 0·15 mm. in length, 0·05 mm. in diameter, and rounded in cross-section. The rays usually make right angles with adjacent rays, taper gradually at first near the node, and then sharpen rapidly to pointed terminations (see Pl. II. figs. 24–27, and text-fig. 2). A few hexactons have both the rays on a single axis each longer than any one of the four other rays, which, usually, are of equal length.

The most minute of the six-rayed microscleres possess tapering rays about 0·05 mm. or even less in length. The rays are symmetrically disposed about the node, and adjacent rays are at right angles to one another. This form corresponds closely in size and in shape to Pulfrey's figure (*op. cit.* text-fig. 2 (2)) of a microsclere of *P. minuta* (see Pl. II. figs. 29, 30).

Four-rayed Spicules.—Amongst the microscleres may also be placed some four-rayed spicules of small size and "stauracton" appearance (Pl. II. figs. 20, 21).

Spherasters.—A few minute spherasters have been seen, but they are more definitely recognizable in microsections than they are in the isolated state.

Amphidisc.—The most noteworthy of the microscleres is that figured on Pl. II. fig. 22. It resembles in all respects one "umbel" of an amphidisc, and therefore its discovery is of importance as showing that the reference of the Ordovician hexactinellid sponges (at least in part) to the Amphidiscophora is in accord with the classification of living sponges of this group, and especially with that of the Hyalonematidæ, which are characterized by the presence of amphidiscs. Only one such spicule has so far been obtained from the phosphate. In this the interior of the umbel is occupied by some of the matrix, but about ten prongs can be determined of which five are complete and show by their spacing that the number of prongs was twelve originally. The reverse aspect of the umbel also shows its umbrella-like form cleft at the margin into curved, tapering, and pointed prongs * (see text-fig. 1 (20)).

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* After this spicule had been isolated from the matrix, photographed and studied, it disintegrated during an attempt to mount it permanently.

Pyritonema delicata Pulfrey.
(Pl. II. figs. 16, 18, 19, 23 ; text-fig. 2 (19, 20).)

Pyritonema delicata Pulfrey, 1933, Ann. & Mag. Nat. Hist. ser. 10, vol. xi. pp. 74–75, text-fig. 2 (10–17, 19).

Megascleres.—Hexactons with rays about 0·5 mm. long, but thinner than in *P. minuta* (0·05 mm. or less), and which keep the same thickness almost throughout their length, are assigned here to *P. delicata* Pulfrey. They also show some resemblance to certain of the hexactons referred by Rauff ('Palæontographica,' vol. xl. pl. vi. figs. 10, 13, 14) to *P. gracile* (Hinde), emend. Rauff.

Microscleres.—Very delicate, fragile spicules of dimensions comparable to those of both the larger and the smaller microscleres of *P. minuta*, but with thinner rays, are regarded as microscleres of *P. delicata.* They are not common, probably on account of the ease with which they are destroyed during the process of isolation from the phosphate.

PLECTODERMA Hinde.

1883. Hinde, G. J., Catalogue of Fossil Sponges Brit. Museum, p. 132.

Hinde bases his diagnosis of this genus on the appearance of a portion of the wall of the sponge, which is constructed of a thin spicular meshwork of cruciform and five-rayed spicules and possibly of "linear spicules." Smaller spicules also occur. There are no definite quadrate areas, and the arrangement of the spicules is not so regular as in *Protospongia* Salter and *Dictyophyton* Hall, while the fascicular grouping of the spicular rays in a vertical direction also distinguishes it from *Protospongia.*

Genotype : *Plectoderma scitulum* Hinde, Upper Ludlow, Pentland Hills. Cat. Foss. Sponges, p. 132, pl. xxxi. figs. 1, 1 *a*, & 1 *b*.

Plectoderma cf. *scitulum* Hinde.
(Pl. II. figs. 1, 2 ; text-fig. 2 (1 *a*, 1 *b*).)

Several spicules corresponding to the larger pentactines described by Hinde as belonging to this species occur in the phosphate. The largest of these show one slightly wavy and practically complete ray about 3 mm. long and tapering from 0·3 mm. to 0·1 mm. in thickness, one ray at right angles to the long ray reduced almost to extinction, and four rays broken off not far from the node but, judging from their thickness, obviously of considerable length when complete. The surface of the rays is smooth. There is always evident a slight curvature of the four rays adjacent to the reduced ray away from the plane which is normal to the axis of this ray.

These spicules are fairly common at Pen-y-garnedd, and can be detected in the fractured nodules quite readily without the use of a magnifying lens.

TETRACTINELLIDA.

LITHISTIDA O. Schmidt.

The classification usually adopted for fossil lithistid sponges is that of Zittel as modified by Rauff; but this classification, and, to an even greater degree, the later classification suggested by Sollas, are difficult to apply to isolated desmas of which the canal-system cannot be determined and where the nature of the microscleres with which the desmas were associated in the sponge, originally, are unknown. Under these circumstances the shapes, outward conformation, and sizes of the individual desmas are the only criteria available for use in attempting identification of the sponge of which they formed a part. Further, the desmas are fragile structures, and they are easily broken, with the result that few spicules remain of which the epactines and cladia are all present and complete, while numerous broken individuals exist which are difficult to distinguish from entire spicules of simpler form.

Abundant isolated spicules of the Lithistida are associated with the other siliceous sponge-remains in the phosphate nodules of Pen-y-garnedd. Some of these can be referred to species or to genera of known Lower Palæozoic forms, and the various forms of the desmas indicate that the Tetracladina Zittel, Eutaxicladina Rauff, Anomocladina Zittel, and Rhizomorina Zittel are represented.

TETRACLADINA.

AULOCOPIUM Oswald, emend. Rauff.

Aulocopium cf. *aurantium* Oswald.

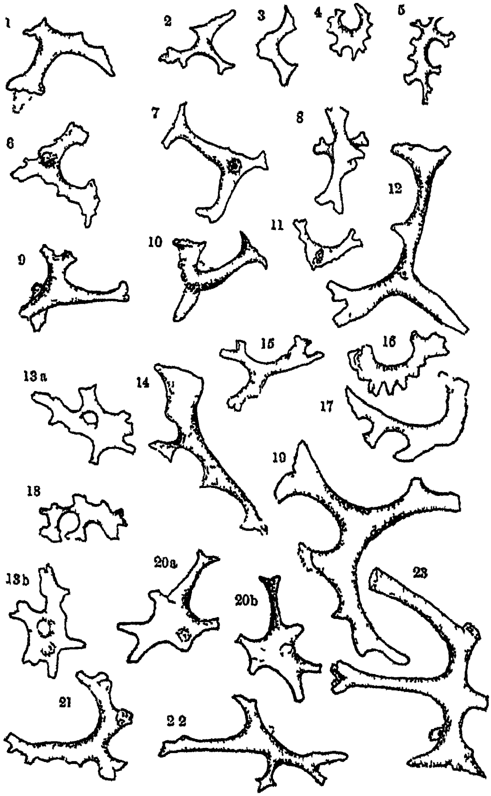
(Pl. I. figs. 19, 20, 21; text-fig. 3 (12, 14, 15, 21).)

Aulocopium aurantium (and *diadema*), Oswald, F. Arbeit. d. Schles. Ges. f. vaterländ Kultur, p. 58, 1847.

Aulocopium aurantium Oswald, Rauff, Palæontographica, vol. xli. 381, pl. xx. figs. 5–15, pl. xxiii. figs. 1–5.

Tetraclons of somewhat irregular shape occur, but they are comparable in size and form to spicules of *Aulocopium*

Text-fig. 3 (1–23).



Tetracladina: 12, 14, 15, 21. *Aulocopium* cf. *aurantium* Oswald. 1, 6, 7, 9, 10. *Aulocopium* cf. *aurantium variabile* Rauff. 8 ?, 20 *a*, 20 *b*, 22. *Chiastonella* cf. *headi* Rauff.
Eutaxicladina: 2, 3, 11, 13 *a*, 13 *b*, 18. *Hindia sphæroidalis* Duncan.
Anomocladina: 17, 19. *Anomoclonella* cf. *zittelli* Rauff. 23. *Pycnopegma* cf. *callosa* Rauff.
Rhizomorina: 4, 5, 16 ?. *Cnemidiastrum* cf. *priscum* Hinde.

All figures ×50. Figs. 2, 3, 14 (slide 33); figs. 13, 18, 20 (slide 34); fig. 12 (slide 35); fig. 19 (slide 39); figs. 1, 4, 5, 6, 8, 10, 11 (slide 50); fig. 7 (slide 53); figs. 15, 16, 17, 21, 22, 23 (slide 67).

aurantium as figured by Rauff in his revision of the characters of the Aulocopidæ. Some of the twig-like terminations of the rays appear to have been destroyed in most instances, but bifurcation of the rays at their extremities is not uncommon. According to Rauff the species is represented in the Ordovician and Silurian rocks of Europe. It occurs in the Jewe, Lyckholm, and Borkholm beds of the Baltic Provinces, and in the Valentian and Wenlock rocks of Gotland.

Aulocopium cf. *aurantium variabile* Rauff.
(Pl. I. fig. 22 ; text-fig. 3 (1, 6, 7, 9, 10).)

Aulocopium aurantium variabile Rauff, 1895, Palæontographica, vol. xli. p. 389, pl. xxiv. fig. 2.

Tetraclons of regular form, with the rays appearing to diverge at an angle of 120° from a common centre, resemble very closely in size and shape the tetraclons of *A. aurantium variabile* as they are figured by Rauff in his description of this variety. It is known chiefly from Drift boulders of Lower Palæozoic rocks occurring in north-eastern Germany.

CHIASTONELLA Rauff.

Chiastonella cf. *headi* Rauff.
(Text-fig. 3 (? 8, 20, 22).)

Chiastonella headi Rauff, 1894, Palæontographica, vol. xl. pl. xvii. figs. 5–7, vol. xli. p. 368, text-figs. 101, 102.

A few desmas have been obtained which correspond to Rauff's figures of the spicules (chiastoclons) of this species, which occurs in the Niagara Group of Tennessee. The chiastoclons usually show six rays radiating from a common centre in nearly the same plane and two rays approximately normal to this plane and emerging on opposite sides of it. This type of chiastoclon corresponds to fig. 101, desma 1 (Rauff, *op. cit.*), while another type with one ray somewhat elongated occurs also and is similar to Rauff's fig. 102, desma *c*. In some respects these desmas resemble those of members of the Eutaxicladina such as *Astylospongia* spp.

EUTAXICLADINA.

HINDIA Duncan.

Hindia sphæroidalis Duncan. (Pl. I. figs. 23, 24, 25 ; text-fig. 3 (2, 3, 11, 13, 18).)

Hindia sphæroidalis Duncan, 1879, Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 84, pl. ix.
Hindia sphæroidalis Duncan, Rauff, Palæontographica, 1894, vol. xl. p. 335, pls. xv., xvi., xvii. (figs. 1–4).

Several isolated spicules (ennomoclons) and a few small portions of the spicular mesh of this species occur in the phosphate. Comparison of these with the figures given by various authorities, and in particular by Rauff and Hinde, leaves no doubt as to their identity with *Hindia sphæroidalis* Duncan (=*Hindia fibrosa* Hinde). The length of the longest rays rarely exceeds 0·16 mm. and the thickness of the rays is about 0·05 mm. The tuberculate ornament of the convex sides of the rays is visible on some but not on all of the rays, while the concave surface is invariably smooth. The rounded or elliptical apertures of the reticulate spicular skeleton have a width which varies between 0·1 mm. and 0·14 mm.

So far as I am aware *H. sphæroidalis* has been recorded in Britain previously only from the Craighead limestones of the Girvan district.

ANOMOCLADINA.

ANOMOCLONELLA Rauff.

Anomoclonella cf. *zittelli* Rauff.
(Pl. I. fig. 26; text-fig. 3 (? 17, 19).)

Anomoclonella zittelli Rauff, Palæontographica, 1894, vol. xl. pl. viii. figs. 1–4; 1895, vol. xli. p. 350, text-figs. 81–82.

Some comparatively large spicules seem to find their nearest representatives in desmas of the above species as figured by Rauff. Owing to the complicated nature of the reticulate skeleton of this sponge it is, however, difficult to ascertain the exact conformation of single spicules. The species occurs in the Niagara Group, Tennessee.

PYCNOPEGMA Rauff.

Pycnopegma cf. *callosa* Rauff.
(Text-fig. 3 (23).)

Pycnopegma callosa Rauff, Palæontographica, 1894, vol. xl. pl. viii. figs. 7–9; 1895, vol. xli. p. 360, text-figs. 93 & 94.

One fairly large desma shows much resemblance to the spicules of *P. callosa* as figured by Rauff, but in this instance also the shape of a single typical desma is difficult to determine from Rauff's figures. The species is recorded from the Niagara Group, Tennessee.

RHIZOMORINA.

Except for the Cambrian genus *Nipterella* (*N. paradoxa* Billings) Hinde, from the Mingan Islands, which Rauff suggests does not belong to the Rhizomorina, this group is almost confined to Mesozoic and later rocks. The form of some of the lithistid spicules at Pen-y-garnedd leaves little doubt that they are from members of the Rhizomorina group of sponges, and these desmas are tentatively referred to the genus *Cnemidiastrum* Zittel.

CNEMIDIASTRUM Zittel.

Cnemidiastrum cf. *priscum* Hinde.

(Text-fig. 3 (4, 5, ? 16).)

Cnemidiastrum priscum Hinde, G. J., Brit. Foss. Sponges, p. 155, pl. v. fig. 6.

The desmas of the Rhizomorina at Pen-y-garnedd vary somewhat in shape. In some this is close to that of spicules of species of *Cnemidiastrum* figured and described by Schrammen recently from the Cretaceous of Germany, but the more definite forms can equally well be compared to Hinde's Carboniferous species *C. priscum*. The desmas in the phosphate are isolated, of irregular form, but characterized by small twig-like extensions and projections. The most typical form observed (text-fig. 3 (5)) is about 0·27 mm. in length and has a maximum width of about 0·1 mm. The Ordovician form is therefore much smaller than that from the Carboniferous Limestone, attaining less than half its size.

CHITINOZOA Eisenack.

Axially symmetrical organisms with rod-, club-, flask-, or trumpet-shape form ; structureless, chitinous membrane open at the proximal end and probably closed at the distal end, but this may have a very slight aperture. The size varies between 0·07 and 1·5 mm. The membrane frequently carries surface-spines.

Conochitinidæ Eisenack.

General form conical ; greatest breadth near the distal end.

CONOCHITINA Eisenack.

Genotype : *Conochitina claviformis*, Silurian. A. Eisenack, Pal. Zeit. 1931, xiii. p. 84, pl. i. fig. 17. (Diagnosis as for the family.)

Conochitina cf. *filifera* Eisenack.

(Pl. III. fig. 1.)

Conochitina filifera Eis. Pal. Zeit. 1931, vol. xiii. p. 85, pl. i. figs. 14, 15, 16.

The section figured gives a good conception of the form of this species, which is narrow at the open, proximal end of the cylindrical neck and expands from this to the flattened distal end. Length, 0·12, greatest width 0·072 mm. ; ratio of length to average breadth 1·8 : 1.

The surface of the membrane is set with short, delicate spines, which are not very conspicuous. It is possible that in the specimen figured shrinkage of the membrane away from the enveloping matrix has given space for the deposition of silica around the outside of much of the surface of the organism, with the result that, had the organism been removed from the matrix by treatment with hydrofluoric acid, few or no spines would have been seen. Information obtained from the study of these fossils (and also of the Hystrichosphærids) in rock-sections serves therefore as a check on the method of isolating them by dissolving away the matrix enclosing them.

In form, size, and paucity of spines the Welsh form agrees with *C. filifera* Eis., and perhaps even more closely with *Conochitina* cf. *filifera* Eis. from the Dlouka hora Beds (E_2) of Bohemia *.

Phosphate-band, Caradocian, Pen-y-garnedd.

Conochitina cactacea Eisenack.

(Pl. III. fig. 2.)

Conochitina cactacea Eis. Pal. Zeit. 1937, vol. xix. pp. 222–3, pl. xv. figs. 14 & 15.

Longitudinal sections of this species from Pen-y-garnedd have the shape of a conical flask, and are in this respect similar to those of *C.* cf. *filifera* described above, but the surface of the membrane is beset with spines which are more conspicuous than in the latter species. The spines in the figured fossil are stronger and wider apart towards the proximal end and shorter at the broad distal end. Length, 0·12 mm., greatest width 0·070 mm., width of proximal (apertural) end 0·04 mm.; ratio of length to average width 1·8 : 1. These figures agree well with those given for the smaller forms of this species by Eisenack, who records it from boulders of the Vaginatenkalk.

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* Pal. Zeitschrift, 1934, vol. xvi. pp. 68–69, pl. v. figs. 18–24.

Phosphate-band, Caradocian, Pen-y-garnedd

HYSTRICHOSPHÆRIDA.

Hystrichosphæridæ O. Wetzel.

Ehrenberg * appears to have been the first to devote attention to the organisms which are now included in the Hystrichosphærida. These bodies are usually spherical or polygonal, they may or may not possess spinous processes attached to and radiating from the surface of the test, and the processes may be simple or they may fork near their extremities. The bodies are of microscopic size and, excluding the processes, the diameter is usually less than 0·1 mm. Ehrenberg referred the bodies to the genus *Xanthidium* of the Desmidiaceæ, and figured several species from the Chalk of the Moen and Rügen Islands and from the Cretaceous cherts of Saxony and the Jurassic cherts of Poland.

Organisms identical with Ehrenberg's "*Xanthidia*" were described from the Mesozoic rocks of England nearly a century ago †. These appear to be the only British forms recorded so far, although reference has been made to the group in later publications ‡.

M. C. White § discovered similar organisms in the Lower Devonian and Ordovician rocks of New York. These he and (later) Dana || figured and referred to the

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* Ehrenberg, C. G., Abhand. Konigl. Akad. Wiss. z. Berlin (1836), 1838, pp. 109–136, 2 pls.; Berlin Akad. Wiss. 1843, pp. 61–62, and 'Mikrogeologie,' Leipzig, 1854, pls. xxix., xxx., xxxvii. etc.

† White, H. H., Trans. Micr. Soc. London, i. 1844, p. 87, pl. xx. fig. 4; Micr. Journ. & Structural Record for 1842, ii. p. 1, pls. xxxv.–xl.; Bowerbank, J. S., Micr. J. & Str. Rec. for 1841, i. 1842, pp. 99–102, 113–115, & 131–135.

‡ Griffith, J. W., and Henfrey, A., 'Micrographic Dictionary,' London; 1883, and other editions.

§ White, M. C., Amer. Jour. Sci. & Arts, xxxii. 1862, pp. 385–6, 28 figs.

|| Dana, J. D., 'Manual of Geology,' 1874 (2nd edit.), p. 257, figs. 484 *Aa–e*.

Xanthidia and the desmids. This seems to be the earliest record of these bodies from Palæozoic rocks.

Now, although there is close resemblance in form and in size between the fossil organisms under consideration and the zygospores * of desmids now living, like *Xanthidium*, *Closterium*, *Staurastrum*, *Micrasterias*, etc., the latter have a freshwater habitat, while the former always occur in marine sediments. Consequently other suggestions concerning their true affinities have from time to time been put forward. Thus, Rothpletz discussed their nature in 1880, when he recorded them for the first time from the Lower Palæozoic rocks of Europe under the name *Sphærosomatites* †. He noted their similarity to Ehrenberg's *Xanthidia* and also to the American fossils figured by White and Dana, but he found it impossible to decide whether they were plants or animals. But it was not until the present century that their relegation to the desmids was seriously questioned, and in a recent text-book ‡ on palæobotany Ehrenberg's fossils are still classified as desmids.

Following the work of H. Lohmann § on the recent plankton, Fuchs, in 1905, suggested that the fossil "Xanthidia" might be the eggs of pelagic Crustacea ||. This opinion was shared by W. Wetzel ¶ (1922) and, in 1931, by A. Eisenack ** in his account of the spiny "cysten" which he isolated from boulders of Ordovician and Silurian limestones in the Quaternary deposits of northern Germany. Kraft †† explained these organisms as graptolite "eggs" in his description of the ontology and biology

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* See, for example, West, G. S., 'British Fresh Water Algæ,' 1904, pp. 141–172, and Fritsch, F. E., 'The Structure and Reproduction of the Algæ,' 1935.

† Rothpletz, A., Zeit. d. geol. Ges. xxxii. 1880, pp. 447–467, 1 plate.

‡ Pia, J., in Hirmer, M. Handbuch der Paläobotanik, 1927.

§ Lohmann, H., Ergebn. d. Plankton-Exped. vol. iv. pp. 1–61. Kiel, Leipzig, 1904.

|| Fuchs, Th., Uber die Natur von Xanthidium Ehrenb., Zbl. Min. 1905, p. 340.

¶ Wetzel, W. N., Jahrb. f. Min. vol. xlvii. 1922, pp. 39–92, 3 pls.

** Eisenack, A., "Neue Mikrofossilien des baltischen Silures.—I.," Palæont. Zeitschrift, vol. xiii. 1931, pp. 74–118, 5 figs., 5 plates; II., *ibid.* vol. xiv. 1932, pp. 257–277, 13 figs., 2 pls.; III. (und Neue Mikrofossilien des Bohemischen Silurs, I.), *ibid.* vol. xvi. 1934, pp. 52–76, 35 figs., 2 pls.; IV., *ibid.* vol. xix. 1937, pp. 217–243, 22 figs., 2 pls.

†† Kraft, P., Palæont. Zeit. vol. vii. 1926, p. 247.

of species of *Monograptus* and *Diplograptus*, while Weigelt [*] has gone so far as to relate these structures to the very dissimilar *Pachytheca* Hooker. Comparisons of these organisms has also been made to sponge-gemmules, the " eggs " of Hydra-like forms, the statoblasts of the freshwater *Cristatella*, and the " eggs " of *Halcyonella*.

The recent work on these fossils has been carried on chiefly by G. Deflandre in France and A. Eisenack and O. Wetzel in Germany. Eisenack at first compared the Ordovician and Silurian forms to the " eggs " and " cysten" of the recent plankton. O. Wetzel [†], in a paper dealing with Cretaceous forms, refused to accept the organisms as the eggs of Crustacea, and erected a new family, the Hystrichosphæridæ, to receive them. He named four genera—*Hystrichosphæra*, *Membranilarnea*, *Disphærogena*, *Triblastula*—and several species.

In his work on the microfossils of the Cretaceous flints of the Paris Basin Deflandre [‡], in the main, followed O. Wetzel's classification, and added two new genera—*Hystrichosphæridium* and *Michrystridium*—and a number of new species. He also suggested the classification of the Palæozoic forms as separate special genera, distinct from later forms, and while, like O. Wetzel, he states that he has failed to find a single " egg " of a living crustacean (Copepoda) in the plankton which could be identified with members of the Hystrichosphæridæ, he recognizes the possibility of their existence in the flints and cherts. Further, with regard to this he points out that there are hosts of organisms of extremely varied form, constructed on the same general plan as the hystrichosphærids (a more or less regular sphere or polyhedral body bristling with filaments which may be either pointed or forked), and that they could as easily be assumed to belong to the Protistes (Infusoria, algæ, flagellates) as to the Metazoa (Crustacea, rotifers, tardigrads).

As a consequence of his more recent investigations

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[*] Weigelt, J., Zeitsch. f. Geschiebeforsch. vol. vi. 1930, pp. 7–8.

[†] Wetzel, O., ' Palæontographica,' 1933, vol. lxxvii. pp. 141–186; vol. lxxviii A, pp. 1–110, Stuttgart. Ztschr. f. Geschiebeforsch. vol. viii. 1932, pp. 129–146.

[‡] Deflandre, G., Ann. de Palæont. vol. xxvi. 1937, pp. 56–84, pls. xi.–xvii.

Eisenack * refers the Lower Palæozoic "cysten" of his earlier papers to the order Hystrichosphærida represented by the family Hystrichosphæridæ O. Wetzel (genera *Hystrichosphæridium* Deflandre and *Leiosphæra* Eisenack) and the family Leiofusidæ Eisenack, with the one genus *Leiofusa* Eisenack †.

Eisenack, like O. Wetzel and Deflandre, has employed microchemical methods in attempts to determine the constitution of the organic substance composing the Hystrichosphærida, and so to provide evidence of that nature to help to fix the true systematic position of the group. Chiefly as a result of the resistance offered by the membranes of the Lower Palæozoic hystrichosphærids to various acids and oxidising agents he has come to the conclusion that they consist of cutin or of a similar substance. After prolonged treatment with nitric acid and potassium chlorate the integument, however, is destroyed, and as like treatment has a similar effect on Tertiary hystrichosphærids which Eisenack has isolated from a phosphate-deposit ‡, he relates the Palæozoic forms to the Hystrichosphæridæ on the evidence of similarity not only of morphological construction but also of chemical nature.

The chemical line of approach to the problem is much hindered because little or nothing concerning the composition of recent planktonic "eggs," "cysten," or "kystes," nor about their resistance to chemical action, is known. Cutin is characteristic of the cuticle of the higher plants, but, in view of the early geological horizon at which the Hystrichosphæridæ appear, it is improbable that they represent the spores of such plants. Deflandre seems to have little faith in the adequacy of microchemical methods in this instance, owing to the changes which the integuments have suffered in colour and in composition in the fossil state—changes which tend to reverse or negative reactions which are applicable to comparable living forms §.

It would seem, therefore, that no certainty exists even yet concerning the true nature of the Hystrichosphæridæ. The old problem of the "Xanthidia" of Ehrenberg has been replaced by the "Stacheleierproblem," or problem of the hystrichosphærids, of recent German authors. All that has been achieved is classification into genera and species which at best are to be regarded merely as form-genera and form-species.

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* Eisenack, A., Zeitsch. f. Geschiebeforschung und Flachlandsgeologie, vol. xiv. 1, pp. 1–30, 1938.

† Eisenack, A., *ibid.* 1938, pp. 4–11.

‡ Eisenack, A., Schriften der Phys. okon. Gesellschaft zu Konigsberg, vol. lxx. 1938, pp. 181–188.

§ Deflandre, G., *op. cit.* 1937, p. 60.

As Dr. Eisenack has devoted most attention within recent years to the Palæozoic members of the group, and as he has studied more abundant and better preserved material than that which, so far, has been obtained from the Pen-y-garnedd phosphate, I have deemed it advisable to adopt his classification in this paper.

HYSTRICHOSPHÆRIDIUM Deflandre.

Spherical to star-shaped forms with radial processes.

Genotype: *Xanthidium tubiferum* Ehrenberg, Abh. Konigl. Akad. Wiss. z. Berlin, (1836) 1838, pl. i. fig. 16.

Hystrichosphæridium longispinosum Eisenack.
(Pl. III. figs. 3–7.)

Ovum hispidum longispinosum Eis., Pal. Zeitsch. 1931, p. 110, pl. v. figs. 6–17.

Hystrichosphæridium longispinosum Eis., Zeit. f. Geschf. 1938, p. 12, pl. i. figs. 1–9.

Eisenack has described and figured recently several examples of this species, which he records from several horizons in the Baltic Ordovician. The tests of the specimens which occur in the phosphate at Pen-y-garnedd average about 0·05 mm. in diameter, and (in addition) the appendages are from 0·04 mm. to 0·06 mm. in length and up to one and a half times the diameter of the test. Some tests are spherical (Pl. III. fig. 3), but the majority show a more or less pronounced polygonal outline, similar to several of those figured by Eisenack. The appendages are invariably broader at their bases of attachment and when unbroken taper to a sharp point. In the individuals that have been isolated the appendages are usually straight or only slightly curved; they are also very brittle and fracture easily. Whole spines are sometimes found which have broken away from their union with the test. The number of appendages is not large. In sections, individual tests rarely show more than five or six, while it is rare to find a greater number than fifteen on an isolated individual. The integument and spines are usually opaque.

Hystrichosphæridium trispinosum Eis.
(Pl. III. fig. 8.)

Hystrichosphæridium trispinosum Eisenack, A., 1938, Zeit. f. Geschf. Bd. xiv. pp. 14–15, figs. 2 & 3.

So far one individual only of this species has been found at Pen-y-garnedd and isolated. This possesses three sharp-pointed spines about 0·02 mm. long and projecting from a test of triangular shape as viewed in plan, but which presents a somewhat flattened, elliptical outline when seen from the side. The outline of the test between the spine-bases, even when seen in plan, appears to be somewhat rounded or facetted. The distance between extreme points of adjacent spines is from 0·06 mm. to 0·065 mm., and therefore the Welsh form is smaller than the average of the Ordovician forms from the Baltic region examined by Eisenack, which give 0·08 to 0·1 mm. as the corresponding figures. An identical but unnamed form from the Lower Devonian of America was figured by M. C. White* in 1862, and this is closer in size to the form from Pen-y-garnedd than to the Baltic Ordovician forms.

Hystrichosphæridium multipilosum Eis.
(Pl. III. figs. 9–11.)

Ovum hispidum multipilosum Eisenack, A., 1931, Pal. Zeitsch. p. 111, pl. v. figs. 20–22.

Hystrichosphæridium multipilosum Eisenack, A., 1938, Zeit. f. Geschf. p. 12, pl. i. figs. 12 & 13.

At Pen-y-garnedd and at Cwm Gwynen this species appears to be represented by spherical tests with as many as fifty fairly short spines projecting from the surface, as viewed in section. The tests, excluding the spines, average 0·05 mm. in diameter. Crushed and fractured forms are fairly frequent and are sometimes represented by two approximately equal segments suggestive of the ruptured spore-cases of desmids. Some individuals have been isolated. In the size of the test and in the number and length of the surface-spines the form agrees with Eisenack's figures of *H. multipilosum*. The Baltic form is stated to belong to zones B_3 or C_1 of the Ordovician. It is of interest to note that White has figured a similar form from the Black River Limestone of New York (1862, p. 386, fig. 28). The form occurs in the phosphate-band at Pen-y-garnedd and at a similar horizon at Cwm Gwynen.

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* White, M. C., *op. cit.* p. 386, figs. 1 & 2.

Hystrichosphæridium castaneum Eis.
(Pl. III. fig. 12.)

Ovum hispidum castaneum Eisenack, A., 1934, Pal. Zeitsch. vol. xvi. p. 71, pl. v. fig. 32.
Hystrichosphæridium castaneum Eisenack, A., Zeit. f. Geschf. 1938, p. 12.

A single specimen which corresponds closely with Eisenack's description and figure of this species has been obtained from a shelly limestone near the phosphate-horizon at Cwm Gwynen, about one and a half miles south-west of Pen-y-garnedd. The test is spherical, about 0·075 mm. in diameter, excluding the spines, which are short, broad-based, and sharply pointed. The longest spines are only about 0·02 mm. in length. Although this Welsh form is large compared with the other hystrichosphærids associated with it, the type, figured by Eisenack from the Dlouha hora, zone E_2, is twice its size. The similarity in geological horizon of the Welsh and central European occurrences is of interest.

Hystrichosphæridium cf. *hirsutum* Ehrenb., Eis.
(Pl. IV. figs. 7 & 11.)

Ovum hispidum cf *hirsutum* Ehrenb., Eisenack. Pal. Zeitsch. 1931, p. 111, pl. v. fig. 19.
Hystrichosphæridium cf. *hirsutum* Ehrenb., Eisenack, Zeit. f. Geschf. 1938, p. 12, pl. i. fig. 11.

Some of the forms which have been observed in sections of the phosphate nodules from Pen-y-garnedd approximate more closely to *H.* cf. *hirsutum* Ehrenb. as described by Eisenack than to any other form. The test is spherical, about 0·04 mm. in diameter, and is set with fairly numerous short spines, which are fewer, however, than in *H. multipilosum* and more numerous than in *H. castaneum.* As in all the species mentioned so far, the spines are simple and not forked. Specimens of this form at Pen-y-garnedd often contain aggregates of translucent blood-red globules or crystals of ovoid shape which are probably hæmatite.

Eisenack records this form from Baltic boulders which he suggests may represent zones B_2 and B_3 or C_1 of the Ordovician.

Hystrichosphæridium trifurcatum Eis.
(Pl. IV. figs. 1–6, 9.)

Ovum hispidum trifurcatum Eisenack, A., Pal. Zeitsch. 1931, p. 112, pl. iv. figs. 21–23.
Hystrichosphæridium trifurcatum Eisenback, A., Zeit. f. Geschf. 1938, pp. 16–19, pl. ii. figs. 1–14, text-figs. 4, 5, & 6.

This species is fairly common at Pen-y-garnedd, and shows variations similar to those discussed and illustrated by Eisenack (1938). The diameter of the test, excluding appendages, varies from 0·02 to 0·055 mm., but the usual diameter is 0·05 mm. The processes vary in length, in thickness, and in flexibility. On the isolated specimen figured (Pl. IV. fig. 3) ten processes with trifurcating extremities can be made out. In this instance the test is 0·05 mm. in diameter and the processes about 0·015 to 0·02 mm. in length. Some processes are crumpled, others have snapped off at the base. The bases of the processes are expanded, while the trifurcations conform to Eisenack's type 4 (1938, p. 18, fig. 4).

The form figured in section as fig. 5 (Pl. IV.) seems to come nearest to the type of the species. The trifurcations in some of the forms figured are well shown and the tapering nature of the processes from the base to the furcation is clearly apparent. The test is usually spherical, but polyhedral forms are seen at times.

The species resembles to some extent certain recent pelagic "cysten" and some of Ehrenberg's recent and fossil Xanthidia, but according to Eisenack it is characterized by the forking of all the processes at equal distances from the surface of the test. The range and distribution of the Baltic forms are similar to those stated for *H.* cf. *hirsutum*. White, however, figures a form with the characters of *H. trifurcatum* from the Corniferous Limestone of New York (1862, p. 386, fig. 14).

Hystrichosphæridium cf. *hymenoferum* Eis.
(Pl. IV. fig. 10.)

Hystrichosphæridium hymenoferum Eisenack, A., Zeit. f. Geschf. 1938, p. 19, pl. iii. figs. 2–5.

Forms of this species carry numerous radiating processes consisting of membrane supported by one, two, or three strengthening spines or props. The strengthening stay may function as a midrib or as a lateral support. Some of the forms seen in sections of the phosphate nodules from Pen-y-garnedd resemble the forms of this species figured by Eisenack from the Baltic Ordovician, but until isolated individuals are obtainable for investigation the identification of these forms must remain doubtful.

All the fossils figured and described in this paper, excepting where a statement is made to the contrary, have been collected by the writer from the Upper Caradocian phosphate-band at Pen-y-garnedd, Montgomeryshire.

Since the above account was prepared for the press Eisenack has described Chitinozoa and Hystrichosphæridæ which have been isolated from the Ordovican " Herscheider Schiefer " of the Rhenish " Schiefergebirges " *. The fossils include *Conochitina* spp. and other Chitinozoa, *Hystrichosphæridium longispinosum*, *H.* cf. *hirsutum*, *H. trispinosum*, *H.* cf. *hirsutum* transitional to *H. multipilosum*, *H.* cf. *polygonale*, *H. trifurcatum*, and *Leiosphæra microcystis*, an assemblage which appears to be very similar to that in the phosphate of Pen-y-garnedd.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Haplistion davisi*, sp. n. Two fibres at a bifurcation. × 12. Holotype. Slide P.y.g. 30, Geol. Dept., U.C.W., Aberystwyth.

Fig. 2. *Haplistion davisi*, sp. n. Monaxons. × 20. Slide 50.

Fig. 3. Monaxons, slightly curved, ? *Reniera* spp. × 20. Slide 68.

Fig. 4. Monaxons, ? *Axinella* or *Reniera* sp. × 20. Slide 44.

Fig, 5. Monaxons, ? *Geodites* or *Reniera* sp. × 60. Slide 44.

Fig. 6. Monaxons. × 20. Slide 44.

Fig. 7. Monaxons, straight forms, ? *Reniera* sp. × 20. Slide 44.

Fig. 8. Monaxons, hooked or contort forms, *Cladorhiza* sp. sigmata. × 20. Slide 35.

Fig. 9. *Axinella* cf. *paxillus* Hinde. Monaxon. × 20. Slide 35.

Figs. 10 & 11. *Pyritonema fasciculus* M'Coy. Anchoring spicules. × 20. Slide 56.

Fig. 12. *Pyritonema* cf. *fasciculus* M'Coy, moniliform type. × 20. Slide 62.

Fig 13. *Pyritonema minuta* Pulfrey (= *P. fasciculus* Rauff). Anchoring spicule with recurved surface spines. × 20. Slide 35.

Figs. 14–17. *Pyritonema subulare* (F. Roem.) Rauff. Anchoring spicules with no surface ornament. × 20. Slides 41, 51.

Fig. 18. *Pyritonema* spp. Broken rhabds or rays. × 20. Slide 44.

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* Eisenack, A., " Chitinozoen und Hystrichosphærideen im Ordovicium des Rheinischen Schiefergebirges," Senckenbergiana, vol. xxi. p. 135, 1939.

Figs. 19–21. *Aulocopium* cf. *aurantium* Oswald, Rauff. Desmas. ×20. Slides 33, 35.

Fig. 22. *Aulocopium* cf. *aurantium variabile* Rauff. Tetraclon. ×20. Slide 33.

Fig. 23. *Hindia sphæroidalis* Duncan. Fragment of spicular mesh. ×20. Slide 33.

Fig. 24. *H. sphæroidalis.* Ennomoclon. ×20. Slide 33.

Fig. 25. *H. sphæroidalis.* Three desmas. ×20. Slide 33.

Fig. 26. *Anomoclonella* cf. *zittelli* Rauff. One desma. ×20. Slide 39.

PLATE II.

Figs. 1 & 2. *Plectoderma* cf. *scitulum* Hinde. Two views of a broken "pentacton." ×10. Slide 41.

Fig. 3. *Pyritonema subulare* (F. Roem.) Rauff. Hexacton. ×20. Slide 39.

Fig. 4. *P. subulare.* Hexacton (Possibly a "heteractinellid" form.) ×15. Slide 36.

Fig. 5. *P. subulare.* Hexacton. ×12. One ray reduced. Slide 51.

Fig. 6. *P. subulare.* Hexacton. ×12. Reduced ray more prominent. Slide 51.

Figs. 7–9. *P.* cf. *subulare.* Broken hexactons, showing spicular canals. ×12. Slide 51.

Fig. 10. *P.* cf. *subulare.* Broken hexacton. ×20. Slide 51.

Fig. 11. *Pyritonema minuta* Pulfrey. Hexacton. ×20. Slide 39.

Figs. 12–14, 17. *P.* cf. *minuta* Pulfrey. Hexactons. Fig 12 abnormal. ×12. Slide 53.

Fig. 15. *P.* cf. *minuta.* Hexacton, some rays curved. ×20. Slide 39.

Figs. 16, 18. *P.* cf. *delicata* Pulfrey. Hexactons. ×12. Slide 62.

Fig. 19. *P. delicata* Pulfrey. Hexacton. ×20. Slide 39.

Figs. 20, 21. *P. minuta* ? Microscleres (stauractons). ×20. Slide 40.

Fig. 22. *P. minuta.* One umbel of an amphidisc. ×20.

Fig. 23. *P. delicata.* Hexacton, ? microsclere. ×20. Slide 39.

Figs. 24–27. *P. minuta.* Hexactons, larger microscleres. ×20. Slides 39, 40.

Fig. 28. *P.* cf. *subulare.* Hooked anchoring spicule. ×20. Slide 35.

Figs. 29, 30. *P. minuta.* Hexactons, smaller microscleres. ×20. Slide 50.

Fig. 31. Microsection through the node of a hexacton of *Pyritonema* sp., showing intersection of the broad canals infilled with phosphatic material enclosed in the recrystallized silica of the spicule. Transmitted light. ×270. Slide 12.

Fig. 32. Microsection of a spiculiferous phosphate nodule viewed by transmitted light. ×23. Slide 15.

PLATE III.

Fig. 1. *Conochitina* cf. *filifera* Eisenack. Longitudinal section. ×300. No. 16.

Fig. 2. *Conochitina cactacea* Eisenack. Longitudinal section. ×300. No. 15.

Fig. 3. *Hystrichosphæridium longispinosum* Eisenack. ×350. Section. No. 16.

Fig. 4. *H. longispinosum* Eis. Section. ×560 approx. No. 11.

Fig. 5. *H. longispinosum* Eis. Section, fragment of test with spines. ×500 approx. No. 11.

Figs. 6 & 7. *H. longispinosum* Eis. Isolated tests, showing polygonal outline. Some spines fractured and reduced in length. ×300. No. 47.

Fig. 8. *H.* cf. *trispinosum* Eis. Isolated test. ×300. No. 47.
Figs. 9, 10, & 11. *H.* cf. *multipilosum* Eis. Crushed forms seen in section. (Fig. 9 ×300 approx.; figs. 10 & 11 ×440 approx.) No. 11.
Fig. 12. *H.* cf. *castaneum* Eis. Section. ×325. Shelly limestone, Upper Caradocian, Cwm Gwynen. No 13.

PLATE IV.

Fig. 1. *Hystrichosphæridium trifurcatum* Eis. Section. ×550 approx. No. 11.
Fig. 2. *H. trifurcatum* Eis. Section. ×500 approx. No. 11.
Fig. 3. *H. trifurcatum* Eis. Isolated, some processes crumpled. ×300. No. 47.
Fig. 4. *H. trifurcatum* Eis. Section. ×500. No. 11.
Fig. 5. *H. trifucatum* Eis. Section. ×520 approx. No. 12.
Fig. 6. *H. trifurcatum* Eis. Section. ×500 approx. No. 14.
Fig. 7. *H.* cf. *hirsutum* Ehrenberg, Eis. Section. ×500. No. 12.
Fig. 8. Cf. *H. multipilosum* Eis. or a transitional form between *Hystrichosphæridium* and *Leiosphæra*, with numerous very short spines. Isolated. ×300. No. 47.
Fig. 9. *H.* cf. *trifurcatum* Eis. Section. ×500. No. 11.
Fig. 10. *H.* cf. *hymenoferum* Eis. Section. ×500. No. 12.
Fig. 11. *H.* cf. *hirsutum* Ehrenb., Eis. Section. ×500. No. 11.

All the specimens figured are from the Upper Caradocian phosphate of Pen-y-garnedd, Montgomeryshire, excepting that illustrated as fig. 12 of Pl. III.

The register numbers refer to slides in the author's "Pen-y-garnedd Collection" in the Department of Geology, University College of Wales, Aberystwyth.

II.—*Descriptions of new Species of Ants* (*Hym.*, Formicidæ) *from various Localities.* By HORACE DONISTHORPE, F.Z.S., F.R.E.S., &c., Department of Entomology, British Museum (Natural History).

Subfamily *PSEUDOMYRMINÆ* Forel.

Tribe PSEUDOMYRMINI Forel.

Pseudomyrma nigra, sp. n.

☿. Deep black, dull, mandibles, funiculi, neck, tarsi, and apex of gaster brown. Whole body clothed with longer and shorter scattered erect black hairs or bristles.

Head very broad, rounded posteriorly, narrowed anteriorly, finely reticulately punctured; *mandibles* massive, with large deep scattered punctures which are oblong near masticatory border, slightly shining; *clypeus* very transverse and narrow, projecting in middle, suture separating it from rest of head semicircular on each side; *eyes* very large, prominent, and kidney-shaped; *ocelli* very small, but distinct; *antennæ* thick, *scapes* reaching a little beyond centre of head, *funiculi* gradually thickened and then narrowed to apex, all the joints longer than broad. *Thorax* rather long, *pronotum* sculpture as in head, transverse, dorsal surface quite flat, strongly rounded anteriorly but with distinct but very blunt shoulders, side-margins straight, very sharply defined; *mesonotum* transverse, raised but flat, similar puncturation as in head and pronotum, anterior border semicircular, sides rounded, posterior border nearly straight; *meso-epinotal* suture wide, with longitudinal not close raised ridges; *epinotum* long, the puncturation more rugose than that of rest of thorax, *dorsum* considerably longer than declivity, with distinct side-margins, longitudinally striate, *declivity* not abrupt, transversely striate; *petiole* pedunculate, widened posteriorly, with distinct side-margins, transversely striate, armed beneath with a longitudinal ridge ending in a small pointed tooth at apex, sides very finely punctured; *postpetiole* considerably broader behind than petiole, narrowed in front, broadest just before apex, very finely longitudinally striate; *gaster* oblong-oval, sculpture as in postpetiole, broadest just before apex of first segment, somewhat smooth and shining beneath; *sting* moderate.

Long. 8·4 mm.

British Guiana: Essequibo River, Moraballi Creek.

Taken by O. W. Richards, 14. ix. 29. Oxford University Expedition. No. 2095.

This species comes nearest to *M. godmani* Forel from Panama, but is considerably larger, and its sculpture and structure is different.

Subfamily *Myrmicinæ* Lepeletier.

Tribe SOLENOPSIDINI Forel.

Liomyrmex froggatti, sp. n.

♀. Shining black, femora and coxæ brown, antennæ, tibiæ, tarsi, articulation of legs and wings, and apex of gaster yellow, apex of segments of gaster pale yellow. Body clothed with sparse longer and shorter outstanding yellow hairs, forming a short fringe at neck directed backwards. Pubescence yellow, very short, sparse, and decumbent, more conspicuous on petiole and postpetiole.

Head subquadrate, posterior angles rounded, posterior border slightly sinuate, with a distinct margin before neck, very finely punctured, the punctures being very small and shallow; *mandibles* long, external border curved, masticatory border armed with teeth, the apical two being the longest, evenly punctured; *clypeus* flat,

Fig. 1.

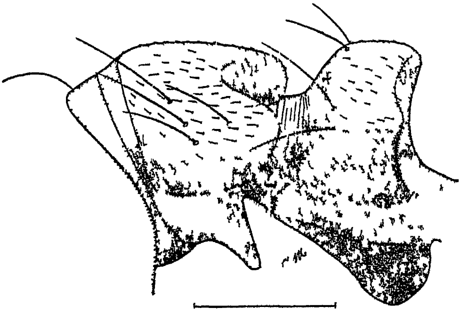
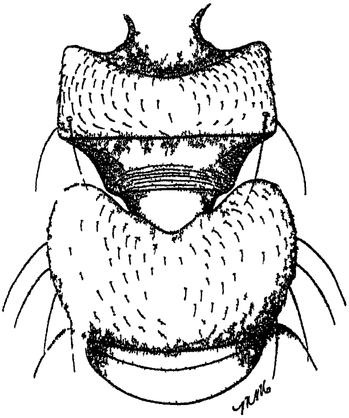


Fig. 2.



Liomyrmex froggatti, sp. n., ♀.

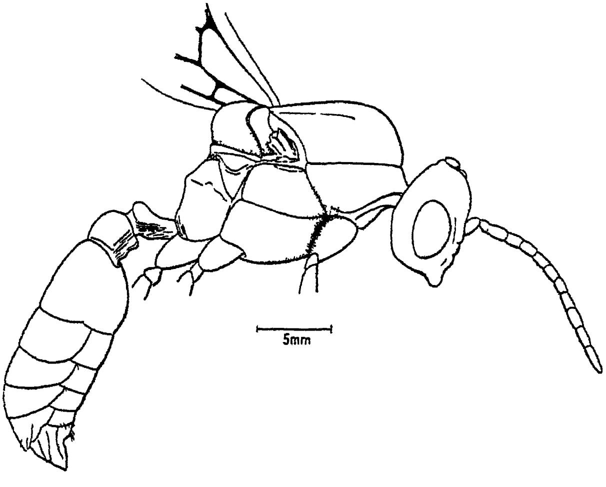
Fig. 1.—Petiole and postpetiole in profile.
Fig. 2.—Ditto from above.

anterior border straight; *frontal area* indistinct; *frontal carinæ* wide apart, anterior angles rounded, sides straight, divergent posteriorly, *frontal furrow* indistinct, terminating in an oblong shallow fovea in centre of front; *antennal foveæ* large and deep; *eyes* large, circular, not very prominent, situated a little in front of middle of sides of head; *ocelli* moderate; *antennæ* 11-jointed, *scape* short, thickened to apex, not reaching halfway to posterior angles of head, *funiculus* gradually thickened to apex, first joint triangular, longer than broad, broader than the next four or five joints, longer than the following two taken together, joints 2–7 transverse, last joint pointed at apex, about as long as the two preceding taken together. *Thorax* long, rather flat above, puncturation very fine, similar to that of head in pronotum and mesonotum, that of præscutellum, scutellum, and epinotum being closer and stronger; *pronotum* narrow, projecting over neck, rounded anteriorly, divided from mesonotum by a deep suture and encircling the same at sides in front; *mesonotum* longer than broad; *scutellum* not very convex, *metanotum* narrow; *metanoto-epinotal suture* deep; *epinotum* convex, sides rounded and narrowed to base, *declivity* concave and tranversely striate, sides of declivity margined and very bluntly tuberculate at apex; *episternite* and *sternite* of *metathorax* longitudinally striate; *petiole* very transverse, narrow, and flat above, sides straight, anterior border evenly and slightly excised, posterior border rounded, *peduncle* short, anterior face of petiole concave, smooth and shining, underside of petiole consisting of a narrow long ridge ending in a blunt round point anteriorly, posterior portion of petiole behind and below dorsal surface just before junction with postpetiole narrow, round, and finely transversely striate; *postpetiole*, dorsal surface flat, very deeply excised anteriorly, forming two bluntly pointed lobes, rounded at sides and posteriorly, junction with gaster behind and below dorsal surface very finely punctured and transversely striate, underside armed with a rather long sharp tooth pointing downwards; *gaster* long, cylindrical, very slightly narrowed to apex, apex of last segment pointed; *sting* not visible. *Legs* moderate, *femora* compressed, anterior pair concave on inner surface. *Wings* yellow, one *discoidal cell*, one *cubital* and long closed *radial cell* present; *pterostigma* and *veins* brown.

Long. 9·2 mm.

♂. Black, shining, whole body very finely coriaceously punctured and with very small scattered punctures; mandibles, tibiæ, tarsi, first joint and end of last joint of funiculus and genitalia yellowish. *Head* without eyes, not as long as broad, posterior border and *cheeks* rounded, inserted on a short neck at the centre of the *gula*; *mandibles* small, masticatory border armed with three small teeth; *clypeus* convex in centre, which is round, and surrounded by an impressed line; *frontal area* narrow, triangular and margined; *frontal furrow* fine, shallow, reaching median ocellus; *eyes* large, prominent, situated on sides of head; *ocelli* placed on posterior border of head; *antennæ* 12-jointed, scape and first joint of funiculus glabrous and shining, rest of antennæ pubescent, *scape* very short, but longer than broad, *funiculus* with very small round first joint, shorter and narrower than scape and rest of antennæ, rest of joints of funiculus longer than broad and of equal breadth,

Fig. 3.



Liomyrmex froggatti, sp. n., ♂.

last joint as long as the two preceding joints taken together, pointed at apex. *Thorax*: *pronotum* narrow, transverse, posterior border round, encircling the mesonotum at sides in front; *mesonotum* high, arched, convex, flatter on dorsum, no *mayrian furrows* present, *parapsidal* furrows very faint, a double impressed line occurs on anterior portion of mesonotum, and a fine narrow carina on posterior half; *præscutellum* more distinctly and closely punctured; *scutellum* high, rounded, very convex; *epinotum* with abrupt declivity longer than the dorsal surface, and with similar very blunt tubercules or points as in ♀ at apex; *petiole* pedunculate, *node* with two round blunt projections on upper surface; *postpetiole* transverse, considerably broader than petiole, sides and anterior border rounded, posterior border almost straight, armed beneath with a blunt short tooth; *gaster* elongate, truncate at base, rounded and narrowed to apex, *pygidium* pointed; *genitalia* elongate, *stipes* long, narrow, angled on external border, sinuate interiorly, *sagittæ* long, compressed. *Wings* as in ♀, but shorter.

Long. 3·6 mm.

New Guinea.

Described from a winged female and a male, taken by J. L. Froggatt in New Guinea.

Type and allotype in B.M. Coll.

The female comes nearest to *L. carinata* Stitz, but is somewhat smaller, and the construction of the petiole and postpetiole is different.

The male of this genus was unknown hitherto.

The following species of *Liomyrmex* have now been described:—

1. *L. cæcus* Smith (sub. *Myrmica*), ☿, Journ. Proc. Linn. Soc. Lond., Zool. iv. Suppl. p. 108 (1860). New Guinea: Dory.
2. *L. carinata* Stitz, ♀, Ber. Naturf. Freunde, Berlin, p. 366, figs. 13, 14 (1911). Dutch New Guinea.
3. *L. aurianus* Emery, ☿, Ann. Mus. Stor. Nat. Genova, xxvii. p. 504 (1889). Berman: Malacca. ♀ and ergatogyne, Forel, Zool. Jahrb. Syst. xxxvi. p. 26 (1913). Malacca.

   L. buttelli Forel, ♀ (sub *Promyrma*), Rev. Suisse, Zool. xx. p. 764 (1912)=*L. aurianus* Emery.

4. *L. gestroi* Emery (sub *Laparomyrmex*), ♀, Ann. Mus. Stor. Nat. Genova, xxv. p. 461 (1887). New Guinea.
5. *L. tagalanus* Menozzi, ♀, Phil. Journ. Sci. xxviii. p. 445 (1925). Philippines.
6. *L. froggatti* Donisthorpe, ♂ & ♀. New Guinea.

Stitz's *L. carinata* was evidently a female by the size, 10·1 mm., and description; but he gave the sign "♀" at the head of his description and "☿" for the locality. Emery gives it as a worker, as he does for Forel's female of *Promyrma buttelli* and also for his own female of *Laparomyrmex gestroi*! [Gen. Ins. 174 B, p. 191 (1922)].

Tribe Leptothoracini Emery.

Leptothorax wollastoni, sp. n.

☿. Lighter or darker brown, head and gaster darker, tarsi tibiæ, base, and apex of femora, articulations of legs, scapes, and apex of funiculi lighter, shining, pubescence yellow, decumbent, very short, sparse and scattered, blunt hairs or bristles, pale yellow, very sparse, very irregularly situated, probably rubbed.

Head subrectangular, longer than broad, slightly narrower posteriorly, posterior angles rounded, mostly smooth and very shining, but with some very small, faint, and shallow punctures; *mandibles* finely striate and punctate; *clypeus* very finely and sparingly longitudinally striate; *frontal carinæ, cheeks*, and borders of *antennal foveæ* very finely striate; *eyes* situated about the middle of sides of head; *antennæ* long, *scapes* scarcely reaching posterior angles of head, *club* not as long as rest of *funiculus*. *Thorax* slender, a little longer than head, finely punctured, not as shining as head, *sternite* of *meso-* and *metathorax* somewhat coriaceously punctured; *mesoepinotal suture* very slight and indistinct; *epinotum* armed with very small short teeth, not as long as the space between them; *petiole* finely punctured, *peduncle* not long, *node* rounded and bluntly pointed; *postpetiole* finely but slightly more distinctly punctured than petiole, quadrate, convex above, sides straight, rounded anteriorly and posteriorly, considerably broader than node of petiole; *gaster* short, truncate anteriorly, sides and apex rounded. *Femora* spindle-shaped.

Long. 2·6 mm.

Described from two workers taken by Wollaston in Madeira (B.M. 1858–21).

Type in B.M. Coll.

One specimen is labelled, in Kirby's handwriting, "subterranea ☿ minor ? ?"; he evidently thought it was an *Aphænogaster*, the colour being similar to that of dark specimens of *Aphænogaster* (*Attomyrma*) *subterranea* Latr. This species comes in the Palæarctic group *rottenbergi* Emery; and in Santschi's table for this group—"5. Epinotum inerme, tout au plus une très petite dent bien plus courte que l'intervalle de leur base." Its sculpture, practically nil, is totally different to any other species in the group.

This is the first record of a *Leptothorax* for Madeira (although there are several specimens of *S. unifasciata* in the general collection at the B.M., taken at Madeira by Wollaston); but Wheeler lists seven species and four vars. for the Canary Islands. For Madeira Wheeler gives fifteen forms of ants, only three of which are endemic.

Santschi, F., Rev. Suisse, Zool. xvii. p. 460 (1909).

Wheeler, W. M., Proc. Amer. Acad. Arts. Sci. lxii. pp. 91–8, 109–11 (1927).

Tribe DACETINI Forel.

Orectognathus versicolor, sp. n.

☿. Head, antennæ, and gaster reddish yellow, front and vertex of head and middle of gaster brownish, thorax, petiole, and postpetiole brown, apex of spines on thorax reddish yellow, madibles and legs yellow, teeth and inner margins of mandibles reddish, eyes black. Whole body more or less shining.

Head triangular, posterior border deeply excised, forming two long bluntly pointed lobes on each side; *clypeus* slightly concave, anterior margin straight, finely and closely punctured; *frontal area* distinct, impressed, smooth and shining; *frontal carinæ* divergent, raised, with a sharply pointed tooth on each side in middle; *frontal furrow* short, narrow, ending in a long shallow oblong pit or fovea; *vertex* of head raised, upper surface of lobes slightly concave; vertex of head and lobes furnished with more or less longitudinal raised ridges, enclosing shallow circular pits; *mandibles* parallel, sinuate on inner margin before teeth and at base, armed with three strongly curved teeth at apex, the one above being the longest, the inner one the shortest; *antennæ*: *scape* long but not reaching posterior border of lobes, *funiculus* with short first joint broader than second, second joint longest, long and narrow, third not as long as half the second, increasing in width to apex, last joint long, thickened in middle, pointed at apex. *Thorax* very finely rugosely punctured, armed with six spines, two at sides of pronotum, projecting outwards and slightly curved forwards, a shorter blunter pair on mesonotum projecting upwards, and a long narrow divergent pair on epinotum slightly projecting upwards, dorsal surface of *pronotum* flat; *meso-epinotal* suture deeply impressed; dorsal surface of *epinotum* convex, twice as long as declivity, which is abrupt; *petiole* with long *peduncle*, finely rugosely punctured. with shining small circular spots, *node* and *postpetiole* less finely punctured, the latter rounded, broader than node of petiole; *gaster* short-oval, smooth and shining; *sting* moderate.

Long. 4·3 mm. with mandibles; mandibles ·7 mm.

Described from a worker taken by R. E. Turner in S.E. Queensland, Tambourine Mts., 18–25. v. 1935.

Type in B.M. Coll.

This distinct species does not agree with the descriptions of any of the known species.

Subfamily *Formicinæ* Lepeletier.

Tribe CAMPONOTINI Forel.

Camponotus (*Colobopsis*) *newzealandicus*, sp. n.

♀. Brown, shining, anterior portion of head reddish yellow, scapes of antennæ and legs dirty yellow, margins of scutellum, insertions of wings, and posterior borders of segments of gaster very narrowly, apex of second segment broadly, yellow.

Head cylindrical, slightly longer than broad, apex circular, abruptly truncate, almost completely margined, including the mandibles in the circle and cutting off part of the clypeus, which is continued on dorsal surface of head, the margins crenulate especially at sides and upper border. The truncate part of head, including mandibles, the cheeks, the rest of clypeus and front of dorsal surface of head strongly and coarsely punctured, posterior portion of head very finely coriaceously punctured and with small, shallow, rather close punctures; *frontal area* indistinct; *frontal furrow* narrow and shallow, reaching small fovea in front of median ocellus; *eyes* large, situated at back of head; *antennæ* inserted at centre of frontal carinæ, *scape* reaching beyond posterior angles of head by about quarter of its length, all the joints of *funiculus* longer than broad, gradually thickened to apex. *Thorax* with similar puncturation to posterior portion of head; *pronotum* transverse, narrow, *pro-mesonotal suture* round, deep; *mesonotum* convex, longer than broad, very narrowly margined anteriorly; *scutellum* transverse, convex; *epinotum* convex, narrowed to base, no angle between dorsal surface and declivity; *scale* of *petiole* thick, transverse, not high, rounded above; *gaster* longer than broad, slightly longer than thorax, base and sides evenly rounded, *pygidium* bluntly pointed. *Wings* wanting. *Legs* moderate, *femora* compressed.

Long. 5·8 mm.

New Zealand (ex Coll. Cameron).

Type in B.M. Coll.

This is the first species of *Colobopsis* to be described from New Zealand.

III.—*A List of the Type-hosts of the Mallophaga and the Lice described from them* *. By GORDON B. THOMPSON.

[Continued from Ann. & Mag. Nat. Hist. ser. 11, vol. iii p. 252.]

Order PELECANIFORMES.

Suborder *PHAËTHONTES.*

Family **Phaëthontidæ.**

107. **Phaëthon æthereus mesonauta** Peters.

Menopon beckii Kellogg, 1906. On *Phaëthon æthereus* from Galapagos Is., Daphne I.

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* *Note.*—It must be borne in mind when using this list that the type-hosts of the various species of Mallophaga are not fixed but only listed.

Saemundssonia phaëthona (Howard), 1890. On *Phaëthon æthereus* from Panama.

108. **Phaëthon rubricauda roseotincta** (Mathews). (Red-tailed Tropic-bird.)

Saemundssonia hexagona (Giebel), 1874. On *Phaëthon phœnicurus* *.

109. **Phaëthon lepturus lepturus** Daudin. (Yellow-billed Tropic-bird.)

Actornithophilus incisus (Piaget), 1880. On *Phaëthon flavirostris* from Madagascar.

110. **Phaëthon lepturus dorotheæ** Mathews.

Saemundssonia uppalensis (Rudow), 1870. On *Phaëthon æthereus* † from Uppala (? =Upolu, Samoa), South Seas.

Suborder *Pelecani.*

Superfamily **PELECANOIDEA.**

Family **Pelecanidæ.**

111. **Pelecanus onocrotalus** (Linn.). (European White Pelican.)

Colpocephalum eucareum Nitzsch in Burmeister, 1838. On *Pelecanus onocrotalus.*
Tetrophthalmus titan (Piaget), 1880. On *Pelecanus onocrotalus*, Rotterdam Zoo.
Pectinopygus (Epipelecanus) forficulatus (Nitzsch in Giebel), 1866. On *Pelecanus onocrotalus.*

112. **Pelecanus roseus** Gmelin. (Eastern White Pelican.)

Tetrophthalmus subtitan Bedford, 1931. On *Metapelecanus roseus* from Portuguese East Africa.

113. **Pelecanus rufescens** Gmelin. (Pink-backed Pelican.)

Tetrophthalmus africanus Bedford, 1931. On *Neopelecanus rufescens* from South Africa.

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* As no locality is stated by Giebel it is possible that this bird may be one of the other subspecies of *P. rubricauda.*

† True *P. æthereus* does not occur in the South Seas, and if Uppala can be taken to mean Upolu, Samoa, the true host is probably the one suggested here.

114. **Pelecanus crispus** Bruch.

Pectinopygus (Epipelecanus) bifasciatus (Piaget), 1880. On *Pelecanus crispus*, Rotterdam Zoo.

115. **Pelecanus conspicillatus conspicillatus** Temminck.

Tetrophthalmus australis Bedford, 1931. On *Catoptropelecanus conspicilatus* from New South Wales.

116. **Pelecanus erythrorhynchos** Gmelin. (American White Pelican.)

Colpocephalum unciferum Kellogg, 1896 (part; see no. 118). On *Pelecanus erythrorhynchos* from Kansas.

Tetrophthalmus consanguineus (Piaget), 1884. On *Pelecanus erythrorhynchus*, Leyden Mus.

Tetrophthalmus impar (Kellogg), 1896, *nec* Menopon impar Piaget, 1885. On *Pelecanus erythrorhynchus* from Kansas.

Tetrophthalmus peralis (Leidy), 1878. On *Pelecanus trachyrhynchus* from Florida

117. **Pelecanus occidentalis** Linn., subsp. (Brown Pelican.)

Tetrophthalmus bursæpelecanæ (Perry), 1876. On *Pelecanus fuscus* *.

118. **Pelecanus occidentalis californicus** Ridgway. (Californian Brown Pelican.)

Colpocephalum unciferum Kellogg, 1896, (part; see no. 116). On *Pelecanus californicus* from California.

Tetrophthalmus linearis (Kellogg), 1896. On *Pelecanus californicus* from California.

119. **Pelecanus occidentalis thagus** Molina.

Tetrophthalmus raggazia Picaglia, 1884. On *Pelecanus trachyrhynchus* from Peru †.

Tetrophthalmus chilensis Grosse, 1885. On pelican from Chile.

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* Since the type-specimens off this hostare lost (see Thompson, 1935) and the only indication of the locality is N. America it is impossible to be certain of the subspecies. It seems probable, however, that this old record refers to *P. o. carolinensis* Gmelin.

† *P. trachyrhynchus* Latham is regarded as a synonym of *P. erythrorhynchos* Gmelin by Peters, but as the only pelican found in Peru is *Pelecanus o. thagus* Molina, it seems reasonable to assume that Picaglia's louse was really collected from this host.

Superfamily **SULOIDEA.**

Family **Sulidæ.**

120. **Morus bassanus** (Linn.). (Gannet.)

Eidmanniella pustulosa (Nitzsch in Giebel), 1866. On *Sula alba.*

Pectinopygus (Pectinopygus) bassani (O. Fabricius), 1780. On *Pelecanus bassanus* from Greenland.

Pectinopygus (Pectinopygus) pullatus (Nitzsch in Giebel), 1866. On *Sula alba.*

Pectinopygus (Pectinopygus) staphylinoides (Denny), 1842. On *Sula bassana* from Britain.

121. **Morus serrator** (G. R. Gray).

Eidmanniella albescens (Piaget), 1880. On *Sula australis.*

Philopterus breviantennatus (Piaget), 1880. On *Sula australis*, Leyden Mus.

122. **Sula nebouxii** Milne-Edwards.

Pectinopygus (Pectinopygus) potens var. minor (Ewing), 1924. On *Sula nebouxii* from Galapagos Is.

123. **Sula sula sula** (Linn.). Red-footed Booby.

Degeeriella castanea (Piaget), 1890. On *Sula piscatrix*, Trouessart coll. ? Straggler.

124. **Sula sula websteri** Rothschild.

Pectinopygus (Pectinopygus) helleri (Kellogg & Kuwana), 1902. On *Sula piscator* * from Galapagos Is., Culpepper I.

Pectinopygus (Pectinopygus) potens (Kellogg & Kuwana), 1902. On *Sula piscator* † from Galapagos Is., Culpepper I.

125. **Sula leucogaster** (Boddaert).

Eidmanniella gigantea (Rudow), 1869 *nec* Menopon giganteum Denny, 1842. On *Sula fiber* ‡.

Pectinopygus (Pectinopygus) annulatus (Piaget), 1880. On *Sula fusca* ‡, Leyden Mus.

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* And stragglers on *Anous stolidus galapagensis* Sharpe, *Sterna fuscata crissalis* Lawrence, *Creagrus furcatus* (Neboux), *Geospiza f. fuliginosa* Gould.

† And stragglers on *Anous stolidus galapagensis* Sharpe, *Oceanodroma t. tethys* (Bonaparte), *Sterna fuscator crissalis* Lawrence.

‡ In the absence of definite locality data it is impossible to say to which subspecies the hosts belong.

126. **Sula leucogaster leucogaster** (Boddaert).

Pectinopygus (Pectinopygus) garbei (Pessôa & Guimarães), 1935. On unidentified host * from Ilha de São Sebastião, Brazil.

127. **Sula leucogaster plotus** Forster.

Pectinopygus (Pectinopygus) sulæ (Rudow), 1869. On *Sula fiber* from South Seas.

Family **Phalacrocaracidæ.**

128. **Phalacrocorax auritus albociliatus** Ridgway.

Pectinopygus (Philichthyophaga) farallonii (Kellogg), 1896. On *Phalacrocorax dilophus albociliatus* from California.

129. **Phalacrocorax olivaceus olivaceus** (Humboldt).

Eidmanniella eurygaster (Nitzsch in Giebel), 1866. On *Halieus brasiliensis.*

Colpocephalum commune Rudow, 1869 (part; see Cuculidæ in later parts). On *Halieus brasiliensis.* ? Straggler.

Læmobothrion † brasiliense (Rudow), 1869. On *Halieus brasiliensis*; probably straggler.

Pectinopygus (Philichthyophaga) depressus (Rudow), 1869. On *Halieus brasiliensis.*

Pectinopygus (Philichthyophaga) gyrocerus (Nitzsch in Giebel), 1866. On *Halieus brasiliensis* from Brazil.

130. **Phalacrocorax sulcirostris** (Brandt).

Eidmanniella subrotunda (Piaget), 1880. On *Gracula sulcirostris*, Rotterdam Zoo.

Pectinopygus (Philichthyophaga) dispar Piaget, 1880. On *Carbo sulcirostris*, Leyden Mus.

Pectinopygus (Philichthyophaga) setosus (Piaget), 1880. On *Phalacrocorax* (*Graculus*) *sulcirostris*, Leyden Mus.

131. **Phalacrocorax sulcirostris territori** (Mathews).

Pectinopygus (Philichthyophaga) confusus (Bagnall & Hall), 1912, *nom. nov.* for *Lipeurus brevicornis* Piaget,

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* The species off this host was placed by the authors in a new subgenus *Micronaubates*. It is evident, however, that the species is really a *Pectinopygus*, and in view of the locality the host may be stated as above.

† This may be *Eulæmobothrion*.

1880, *nec* Denny, 1842. On *Carbo sulcirostris* from Celebes.

132. **Phalacrocorax carbo carbo** Linn.

Eidmanniella brevipalpis (Piaget), 1880. On *Phalacrocorax (Graculus) carbo.*

Degeeriella interrupta (Piaget), 1880. On *Phalacrocorax carbo,* Leyden Mus. Probably straggler from Phalaropidæ.

Pectinopygus (Philichthyophaga) gyricornis (Denny), 1842. Described from straggler on *Sterna hirundo* from Britain.

Pectinopygus (Philichthyophaga) longicornis (Piaget), 1880 (part; see no. 136). On *Phalacrocorax carbo,* Leyden Mus.

Pectinopygus (Philichthyophaga) toxocerus (Nitzsch in Giebel), 1866. On *Halieus carbo.*

133. **Phalacrocorax carbo lugubris** (Rüppell).

Eidmanniella sigmoidale (Picaglia), 1885. On *Graculus lucidus* from Red Sea, Assab.

134. **Phalacrocorax capensis** (Sparrman).

Menopon * pellucidum (Rudow), 1869. On *Phalacrocorax capensis.*

Pectinopygus (Philichthyophaga) acutifrons (Rudow), 1869. On *Phalacrocorax capensis.*

Pectinopygus (Philichthyophaga) capensis (Rudow), 1870. On *Phalacrocorax capensis.*

135. **Phalacrocorax penicillatus** (Brandt).

Eidmanniella kuwani (Kellogg & Chapman), 1902. On *Phalacrocorax penicillatus* from California.

Tetrophthalmus incompositus (Kellogg), 1899. Same data.

136. **Phalacrocorax aristotelis aristotelis** (Linn.).

Pectinopygus (Philichthyophaga) brevicornis (Denny), 1842. On *Phalacrocorax cristatus* from Britain.

Pectinopygus (Philichthyophaga) longicornis (Piaget), 1880 (part; see no. 132 †). On *Phalacrocorax cristatus,* Rotterdam Zoo.

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* This may belong to the genus *Eidmanniella.*

† The type seems to be from *P. c. carbo* Linn.

137. **Phalacrocorax bougainvillii** (Lesson).

Tetrophthalmus transitans Ewing, 1930. On Cormorant * from Chincha I., Peru.

138. **Phalacrocorax atriceps traversi** Rothschild.

Pectinopygus (Philichthyophaga) macquariensis Harrison, 1937. On *Phalacrocorax traversi* from Macquarie I.

139. **Phalacrocorax** sp ?.

Pectinopygus (? Philichthyophaga) subsetosus (Piaget), 1880. On *Phalacrocorax* (*Graculus*) *melanotus*† Leyden Mus.

140. **Haliëtor africanus africanus** (Gmelin).

Menopon eulasium Kellogg, 1910. On *Phalacrocorax africanus* from Tanganyika Territory. ? Straggler.
Pectinopgus (Philichthyophaga) afer (Kellogg), 1910. Same data.

141. **Haliëtor niger** (Vieillot).

Eidmanniella eura (Piaget), 1880. On *Carbo javanicus.*
Pectinopygus (Philichthyophaga) brevisignatus (Piaget), 1880. On *Carbo javanicus*, Leyden Mus.

142. **Nannopterum harrisi** (Rothschild).

Pectinopygus (Philichthyophaga) nannopteri (Ewing), 1924. On *Nannopterum harrisi* from Galapagos Is.

Family **Anhingidæ.**

143. **Anhinga melanogaster** Pennant.

Pectinopygus acutofasciatus (Piaget), 1880. On *Plotus melanogaster* from Java.

144. **Anhinga anhinga** (Linn.).

Pectinopygus anhingæ (Peters), 1935. On *Anhinga anhinga* from Texas.

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* The host given here is merely a suggestion—it is the commonest species occurring at the locality given by Ewing.

† I have been unable to find a present-day name for this bird. Until such time as the type-specimens can be compared with material from known hosts it must remain unplaced except for the genus of birds to which it probably belongs.

Suborder *FREGATÆ*.

Family **Fregatidæ.**

145. **Fregata aquila** Linn.

Pectinopygus (Epifregata) crenatus (Giebel), 1874. On *Tachypetes leucocephalus*, Olfers Coll.

146. **Fregata magnificens rothschildi** Mathews.

Menopon aurifasciatum Kellogg, 1899. On *Fregata aquila* from Panama *.

Colpocephalum spineum Kellogg, 1899. Same data *.

Pectinopygus (Epifregata) (gracilicornis var.) major (Kellogg), 1899 *nec Lipeurus major* Piaget, 1880. Same data *.

147. **Fregata minor** (Gmelin).

Menopon intermissum Harrison, 1916, *nom. nov.* for *M. intermedium* Piaget, 1880, p. 497, *nec* p. 430. On *Atagen* (*Fregata*) *minor*, Leyden Mus.

Colpocephalum angulaticeps Piaget, 1880. On *Fregata* (*Atagen*) *minor*.

Pectinopygus (Epifregata) gracilicornis Piaget, 1880. On *Fregata* (*Atagen*) *minor*. Leyden Mus.

[To be continued.]

IV.—*The Osteology of the Striped Bass* (Roccus saxatilis) †. By DANIEL MERRIMAN. Osborn Zoölogical Laboratory, Yale University, New Haven, Connecticut.

THE osteology of the striped bass (*Roccus saxatilis*) has been studied by both Gregory (1933) and Starks (1901). Sutton (1913) has also figured and discussed the osteology of the skull of the striped bass, but this paper is of interest

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* It is just possible that the true host of these three species is *F. magnificens magnificens* Mathews.

† This work is published with the permission of the Superintendent of the Connecticut State Board of Fisheries and Game, and the U.S. Commissioner of Fisheries. It is part of a dissertation presented or the Degree of Doctor of Philosophy in Yale University.

The striped bass (*Roccus saxatilis*) belongs to the family Serranidæ, n the order Percomorphi. Two specific names (*saxatilis* and *lineatus*) for this fish have been used about equally in the literature, and with little discrimination. In view of Jordan, Evermann, and Clark's (1930) footnote on this species the name *Roccus saxatilis* (Walbaum) appears only with reference to the abnormal specimen that is described. Gregory (*loc. cit.*) has figured the skull alone, but has done it so perfectly that there remains little else to be added. The vertebral column with its appendages and the paired fins (as well as the skull) were figured by Starks (*loc. cit.*), and used by him to illustrate his paper on the " Synonymy of the Fish Skeleton." The drawings were apparently never intended as a detailed study of the osteology of the striped bass, nor is there any description of the osteology of this species accompanying the plates. The present paper therefore attempts to describe the osteology of the vertebral column with its appendages and the paired fins *.

The pectoral girdle with its fin, which is normally made up of 15–17 soft fin rays, is shown from the medial aspect in fig. 1. Since the bones of the pectoral girdle have been figured by both Starks and Gregory, there is no need for comment, except in regard to the post-cleithrum. Contrary to the impression given in these authors' plates, the post-cleithrum (or postclavicle of Parker, see Starks, *loc. cit.*) is made up of two distinct bones, much in the same manner as Schufeldt (1900) has shown for the black bass (*Micropterus dolmieu*). These are shown in fig. 1, the line of division between the superior and inferior post-cleithrum falling slightly above the mid-longitudinal axis of the pectoral fin. The point of junction between the two bones does not fall at the extreme ventral margin of the superior post-cleithrum; instead the inferior post-cleithrum clearly overlaps the ventral medial surface of the superior post-cleithrum (dotted line in fig. 1). The inferior post-cleithrum terminates in a long point, and its general axis does not

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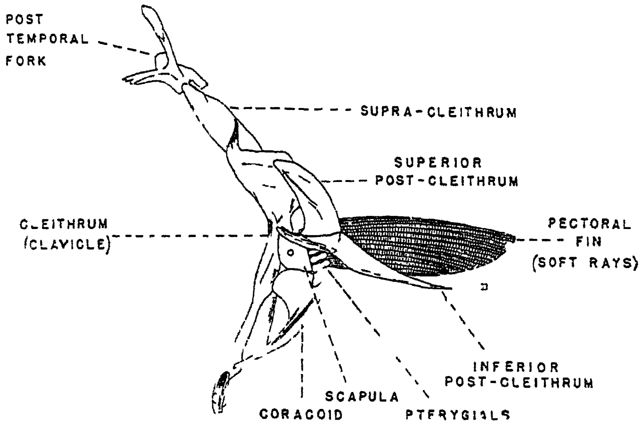
to be the more valid, and lately it has come into more widely accepted usage. Among the common names of this fish are, striped bass, rock or rock-fish, green-heads, squid-hounds, and missuckeke-kequock.

The striped bass is indigenous on the east coast of North America from the Gulf of Mexico to the Gulf of St. Lawrence. It was introduced on the Pacific coast in the last quarter of the 19th century, and the fish prospered so well there that they soon became, and still remain, the object of an intensive fishery (Scofield, 1931).

* The size of the specimens of striped bass on which osteological studies were made varied from approximately 27–45 cm. in standard length.

form more than a 45° angle with the longitudinal plane of the pectoral fin rays.

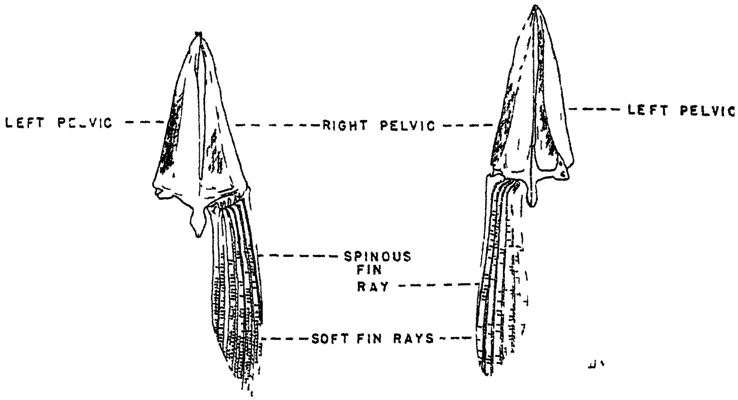
Fig. 1.



Right pectoral girdle—medial aspect. Dotted line at base of superior post-cleithrum indicates area that is overlapped by the dorsal part of the more medial inferior post-cleithrum.

The pelvic bones and fins are shown from the adaxial and abaxial aspects in fig. 2. There are five soft rays

Fig. 2.

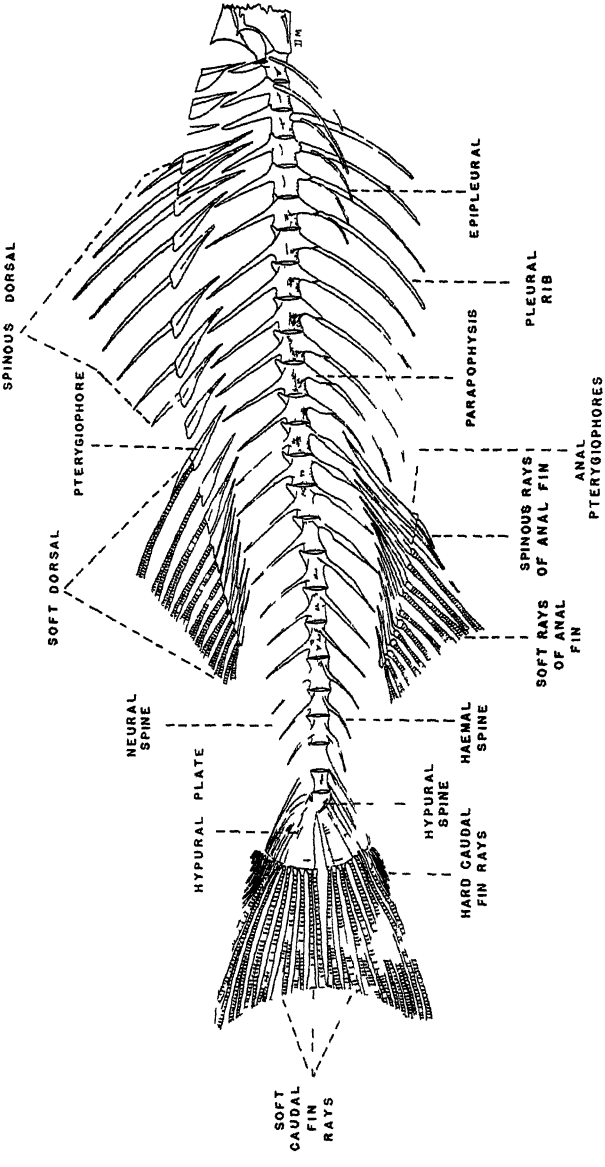


The adaxial (left) and abaxial (right) aspects of the pelvic girdle. See text for explanation of the difference in the most medial pelvic ray in these two views.

and one spinous ray in each pelvic fin of the striped bass, the spinous ray being on the outer edge. The general structure of the dermal fin rays, or lepidotrichia of Goodrich (1904), are so well known that there is no need to describe them here. Suffice it to say that each ray is composed of two parts, which "... correspond from side to side, fitting close together, back to back, so to speak," and form "... apparently single, but really paired rays, capable of being split longitudinally into two. At the proximal extremity the two elements diverge and closely embrace the extremity of the median endo-skeletal fin-support" (Goodrich). In the striped bass there is a bilateral asymmetry of the innermost or most medial pelvic ray, which is due to a difference in structure on its abaxial (ventral) and adaxial (dorsal) surfaces. At the proximal end of this ray the paired elements of which it is composed diverge, but do *not* correspond perfectly as in other rays. The abaxial divergent element is broad and stout, being wider than any of the other fin rays at their bases. The adaxial divergent element, however, is comparatively narrow, and corresponds only with the more lateral half of its abaxial counterpart. Thus when the fin is viewed from the dorsal aspect, the more median half of the proximal end of the broader abaxial element appears as one fin ray and the adaxial element appears as another, whereas in reality these two elements make up a single ray.

There are 25 (12 plus 13) vertebræ including the hypural. Three pterygiophores (interneural spines) are present anterior to the first (spinous) dorsal fin (see fig. 3). The first of these pterygiophores is anterior to the 1st neural spine, while the next two fall between the 1st and 2nd and the 2nd and 3rd neural spines respectively. The 4th pterygiophore bears the first two spines of the dorsal fin; the remaining 7 spines of the first dorsal fin are each supported by a single pterygiophore. The 4th and 5th pterygiophores fall between the 3rd and 4th neural spines, and the 6th and 7th pterygiophores fall between the 4th and 5th neurals. Of the remaining (8th–11th) pterygiophores, which bear the last 4 spines of the first dorsal fin, each falls regularly in the interneural spaces between neural spines 5–9. The 12th pterygiophore falls between the 9th and 10th neural spines. It commonly supports no fin ray, in which case the 13th pterygiophore, falling between the 10th and 11th neural spines, bears

Fig 3



The axial skeleton of the striped bass.

both the 1st (spinous) and 2nd (soft) rays of the soft dorsal fin (as in fig. 3). The 12th pterygiophore may, however, support the 1st ray of the soft dorsal, in which case the 13th pterygiophore bears only the 2nd ray of the soft dorsal, as shown by Starks. There are ten remaining pterygiophores following the 13th. The number of soft fin rays in the second dorsal is usually either 11 or 12. A single soft ray is supported by each pterygiophore after the 13th if there are only 11 soft rays in the second dorsal (as in fig. 3); if, however, there are 12 soft rays, the last pterygiophore (the 23rd) bears the last two soft rays as shown in Starks' plate. The 14th pterygiophore falls between the 11th and 12th neural spines. The relation of the 15th to the 23rd pterygiophores to the neural spines varies somewhat, but in general the 15th to 22nd pterygiophores fall by pairs between the 12th to 16th neural spines, while the last pterygiophore falls between the 16th and 17th neural spines.

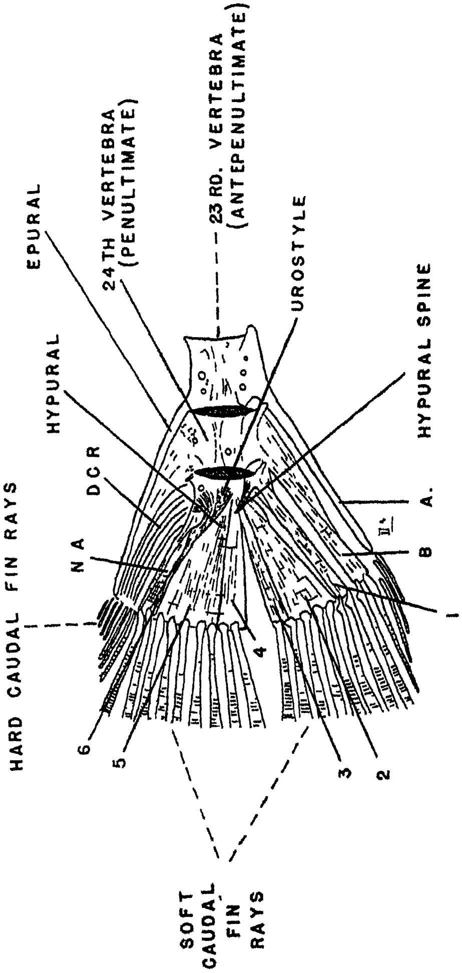
There are always 3 spinous rays (never 4 as indicated by Starks), and most commonly 11 soft rays in the anal fin. There are 12 pterygiophores in conjunction with the anal fin. The first two spinous rays are supported by the 1st pterygiophore, which falls between the last (12th) rib, whose base opposes the tip of the last parapophysis, and the first hæmal spine. The third spinous ray of the anal fin articulates with the 2nd pterygiophore, and each of the succeeding soft rays are in contact with a single pterygiophore, save for the last two soft rays, both of which articulate with the last pterygiophore. The relation of the last 11 pterygiophores to the hæmal spines is irregular; but most commonly the 2nd and 3rd pterygiophores fall between the 1st and 2nd hæmal spines, the 4th–6th pterygiophores between the 2nd and 3rd hæmal spines, the 7th–9th pterygiophores between the 3rd and 4th hæmals, the 10th and 11th pterygiophores between the 4th and 5th hæmals, and the 12th pterygiophore between the 5th and 6th hæmal spines.

There are 12 pleural ribs. The first two of these are strikingly different from the others (fig. 3), not only because they are far less robust, but because their articular facets are situated high on the sides of the first two abdominal vertebræ. The third pleural rib is much heavier, and its articular facet is more ventrally situated on the third abdominal vertebra. The succeeding pleural ribs all oppose parapophyses, which become longer and more robust posteriorly. The first and second pleural ribs are sufficiently long and directed posteriorly so that they overlap respectively the third and fourth pleurals. There are four epipleurals, and these appear one each on the 3rd–6th pleural ribs respectively (fig. 3).

The caudal skeleton of the striped bass has received no attention other than that given it by Starks where it was, of course, included in his plate of the vertebral column and appendages of this species. There is insufficient detail in this plate, however, to make it possible to distinguish the individual bones. A drawing of the caudal skeleton is therefore shown in fig. 4. The nomenclature used throughout is that of Whitehouse (1910). The general osteology of the caudal skeleton of the striped bass compares closely with that of *Serranus cabrilla* (another member of the Serranidæ) as figured and described by Whitehouse (*loc. cit.*). There are 17 large and easily distinguishable soft rays in the caudal fin, 15 of which are branched. Of the four small hypaxial procurrent caudal rays (those most ventrally situated), only the smallest and most ventral is a spinous ray, the three larger rays dorsal to it showing the clearly striated condition typical of soft rays. Of the seven small epaxial procurrent caudal rays (those most dorsally situated), only the four smallest and most dorsal are hard rays, the three larger and more ventral being characteristically striated near their tips. These striations of the small hypaxial and epaxial procurrent fin rays are only clearly distinct with slight magnification; they are therefore not shown in fig. 3, but do appear in fig. 4.

The vertebral column ends in a well-developed urostyle which is slightly longer than the adjacent vertebræ. Lying immediately dorsal to the urostyle and extending well anterior to its tip and posteriorly nearly as far as the end of the hypurals, are a group of several thin, elongate bones (N.A. in fig. 4). Whitehouse finds a single one of these "slender splint-like" bones "protecting the delicate end of the spinal cord," and thinks that "this probably represents one or more neural arches of vertebræ now absorbed into the urostyle" in *Serranus cabrilla*, where, as in the striped bass, the last vertebra has a neural arch of its own. There are three distinct dorsal caudal radials (D.C.R. in fig. 4), whose distal ends support most of the epaxial fin rays. The antepenultimate vertebra possesses a prominent epural bone

Fig. 4.



The caudal skeleton of the striped bass.

whose tip reaches almost as far as those of the dorsal caudal radials. The small cartilage described by Whitehouse as being between the distal ends of the hypurals (A. and B. in fig. 4) of the antepenultimate and penultimate vertebræ, was not observed in the striped bass. The last vertebral segment has six hypural bones (1–6 in fig. 4) associated with it. These vary a great deal in size and shape. The last and smallest of them (6 in fig. 4) starts at the tip of the urostyle and continues in a line with its axis. The second, fourth, and fifth hypurals of the last vertebral segment are broad, fan-shaped plates, while the first and third are considerably narrower and not fan-shaped. The first or anterior hypural associated with the last vertebral segment (1 in fig. 4) possesses a pair of prominent spines at its proximal end, one on each side of the bone. These stick out obliquely at an angle of 45° or more with the plane of the hypurals. They are also directed somewhat dorsally, and were about the same length as the penultimate vertebra in the specimens examined. A search of the literature has revealed no name for these spines, and " hypural spines " are therefore suggested and used by the author to designate them (fig. 4). Whitehouse has figured similar spines for *Serranus cabrilla*, which, although he describes them as " running parallel to the urostyle," are apparently the same. Hollister (1937) also figures what appears to be a similar spine in *Mugil curema*, another Percomorph fish, but she does not mention it in the text. Other than this, the author has been unable to find reference to this spine. It undoubtedly has some significance as a source of muscle attachment.

The caudal skeleton of the striped bass, therefore, is characteristic of the less specialized homocercal tail. The comparatively long urostyle and the large number of hypural bones associated with the last vertebral segment are examples of less specialized homocercy (Whitehouse, *loc. cit.*), and these features disappear in other forms such as the Labridæ that show higher specialization. They are present in the striped bass in such a manner as to indicate definitely its low form of homocercy, and in general the caudal skeleton agrees with that described by Whitehouse for another Serranid, *Serranus cabrilla*.

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V.—*Beiträge zur Kenntnis der Conopiden.*—V.

Von O. Kröber, Hamburg.

(Continued from Ann. & Mag. Nat. Hist. (11) iv. p. 607.)

Paraconops Krb.

Flügelgeäder wie bei *Conops*. Stirn gefurcht. Ozellenhöcker mit 2 deutlichen Ozellen. 1. und 2. Fühlerglied 3 mal länger als breit. Endgriffel 2- (in einer Art 3-) gliedrig.

Bestimmungstabelle der Arten.

1. Kopf ganz gelb. Stirn mit schmaler schwarzer Längsstrieme. Endgriffel 2-gliedrig. 5. und 6. Tergit vorherrschend rotgelb	*P. longicornis* Krb., ♀.
Backen schwarzbraun. Stirn mit breitem schwarzem Fleck. Endgriffel 2-gliedrig. 5. Tergit ganz schwarz	*P. similis*, n. sp., ♀.
Untergesicht ganz schwarz. Stirn mit schmaler schwarzer Strieme. Endgriffel 3-gliedrig. 2., 3. und 6. Tergit ganz schwarz	*P. nigrifacies*, n. sp., ♂.

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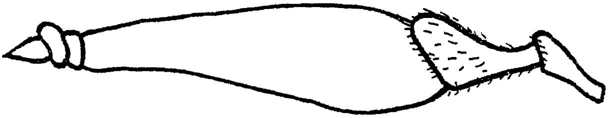
* In this bibliography the page numbers refer to discussions of the striped bass or related subjects cited in this paper—not necessarily to the entire article.

P. similis, n. sp., ♀, v. S.W. Australien, Yallingup, 23. xii.–23. i. Type: London.

Länge 10 mm. Fühler 2·1 mm.; Flügellänge 8 mm., -breite 2·5 mm.

Kopf dunkelgelb, Scheitelblase rötlichgelb, alles ohne Silberglanz. Backen braun, Kiel schwarz; über den Fühlern ein schwarzer Fleck von Fühlerbreite, fast bis zur Scheitelblase reichend. Stirn quergefurcht. Ozellenhöcker schwärzlich, mit 3 rotgelben Ozellen. Rüssel schwarz, dünn, ca. 2½ mal kopflang. Fühler lang. 1. Glied schwarz, ca. 2½ mal so lang wie breit; 2. so lang wie das 1., unten gerade, oben nach der Spitze zu stark erweitert, vorn so breit wie lang. 3. düster rotbraun, nach der Spitze zu verdunkelt. Endgriffel 3-teilig. Hinterkopf oben rotgelb, zart schwarz behaart, unten schwarz. Thorax platte tiefschwarz, glanzlos. Schulterbeulen und Präscutellum, Schildchen und oberer Teil der Pleuren bleich braun, glanzlos. Hüften schwarzbraun, etwas silberschillernd. *p* rotgelb, Tarsen schwarzbraun. Haftläppchen gelbbraun, Klauen rotbraun mit schwarzer Klauenspitze. Behaarung des Thorax und der *p* ganz kurz schwarz. Schwinger und Schüppchen rotgelb. Flügel hyalin mit breiter brauner Binde zwischen r_1 und r_3. Vorderrandzelle hell; 1. und 2. Basalzelle fast hyalin, 1. Hinterrandzelle bis zur *vena spuria* mit feinem braunem Saum am Vorderrand, geformt wie bei *Conops*. Abdomen sehr robust, die Ringe breiter als lang. 1. Ring schwarz, vorn und seitlich etwas rotbraun; 2. rotbraun mit 2 kleinen schwarzen Flecken am Vorderrand; 3. rotbraun mit schwarzem Mittelfleck bis zum Vorderrand, der in den schwarzen Hinterrand übergeht. 4.–6. Ring rein schwarz, glanzlos. Analsegment glänzend rotbraun. Theka dornförmig, schwarz. Behaarung des Abdomens schwarz, kurz. 1.–3. Sternit rotbraun, 4.–6. schwarz.

Fig. 13.



Paraconops similis, n. sp., ♀. Fuhler.

P. nigrifacies, n. sp., ♂, von W. Australien, Marloo Stat., Wurarga, viii.–ix. Type: Berlin.

Länge 11·5 mm. Fühler 2 mm.; Flügellänge 8·5 mm., -breite 2·5 mm.

Stirn dunkelgelb, Scheitelblase rötlichgelb. Untergesicht tiefschwarz, nur die Gruben gelblich mit schwarzem Kiel. Am Augenrand bis zur Fühlerhöhe fein silberglänzend. Partie oberhalb der Fühler tiefschwarz. Stirn mit unklaren Querfurchen, die umbiegen und neben den Augen herabsteigen. Ozellenfleck deutlich, schwarz mit 3 roten Ozellen. Rüssel schwarz, 2 mal kopflang, ziemlich stark. Fühler tiefschwarz, lang, wie bei *P. similis* gebaut, aber das 1. Glied ist wohl 3 mal so lang wie breit. 3. Glied schlanker. Hinterkopf am Augenrand fein silberweiss, äusserst zart schwarz behaart. Thorax tiefschwarz, nur Schulterbeulen, Schildchen, die Beulen daneben und das Präscutellum dunkel weinrot. Innerhalb der Schulterbeulen, hinter ihnen und an den Pleuren zarter weisser Schiller. Hüften schwarz. *p* weinrot, Basen der *f* schwarz, 2.–5. Tarsenglied schwarzbraun. Schüppchen und Schwinger gelblich. Flügel hyalin mit braunem Spitzenfleck zwischen Vorderrand, kleiner Querader, *vena spuria* und Flügelspitze. Hinterleib tiefschwarz, glanzlos. 2. und 3. Segment rotbraun; 6. bis auf einen kleinen Seitenfleck rotbraun. Hinterrand des 1., 2., 3. und 6. Ringes zart silberschimmernd. 1.–3. Sternit rotbraun.

NEOCONOPS Krb.

Flügelgeäder wie bei *Conops*. 1. und 2. Fühlerglied so lang wie breit. Griffel 2-gliedrig. Stirn glatt oder gefurcht. Ozellenhöcker vorhanden.

1.	Kleine Art von 6 mm. mit gefurchter Stirn.	*N. longicornis* Krb., ♂.
	Grössere Art von 8 mm. mit ungefurchter Stirn	*N. robustus*, n. sp., ♀.

N. robustus, n. sp., ♀, von W. Australien, viii. Type: London.

Länge 8 mm. Fühler 1·1 mm.; Flügellänge 5·1 mm., -breite 2 mm.

Macht den Eindruck einer schwarzen *Myopa*, kurz und gedrungen; Abdomen so lang wie Kopf und Brust. Kopf ganz dunkelrotgelb, glanzlos. Nur am Augenrand liegt im mittleren Teil weisser Schimmer. Ozellenhöcker fehlt. Hinterkopf oben schwarz, glanzlos, unten rotgelb. Rüssel ca. 2 mal kopflang, schwarz, ziemlich stark. Fühler tiefschwarz. 1. Glied kaum um die Hälfte länger als breit. 2. fast dreieckig, so lang wie das 1., vorn so breit wie lang. 3. gut 4 mal so lang wie das 2., oben mit geradem Rand, unten mässig ausgebuchtet. Griffel kaum abgesetzt, sehr kurz, 2-teilig. Stirn, Scheitel und Hinterkopf dicht, kurz abstehend weisslich behaart. Augen lang oval, ca. 3 mal so hoch wie die Backen breit. Gesichtsgruben glanzlos, mehr gelb als rotgelb. Kiel gelb. Thorax schwarz, mit stahlblauem Schein, ziemlich glanzlos, innerhalb der Schulterbeulen mit weisslichem Schiller. Behaarung kurz, wollig, weissgrau, Borsten schwach, schwarz. Brustseiten schwarz, mit weisslichem Schiller, aber unklar, keine Strieme. Schwinger weissgelb, Stiel bräunlich. Schüppchen weiss, ebenso behaart. Flügel graulich hyalin, mit zarten gelbbraunen und schwarzen Adern. 1. Hinterrandzelle wie bei *Conops*. Hüften schwarz, weiss bestäubt, besonders die vorderen. *p* schwarz. Vordertarsen fehlen. Basalhälfte der *t* gelb. Abdomen schwarz mit stahlblauem Schein, fast glanzlos. Vorderrand des 2. Ringes weisslich schimmernd, nach den Seiten sich verbreiternd. 3. mit solchem Seitenfleck. Theka gross, dornförmig, schwarz. Hinterleibbehaarung ziemlich dicht und lang, schwarz, besonders am 1., 2. und 6. Ring.

HETEROCONOPS Krb.

1.	Kleine Arten von 2·5–4 mm. Stirn gelb ..	2.
	Grössere Arten von 5 mm. Stirn grösstenteils schwarz	3.
2.	3. Fühlerglied lang und dünn, an der Basis breit, dann unten ausgehöhlt	*H. gracilis* Krb., ♂♀.
	3. Fühlerglied schwer gebaut, an der Basis breit und breit convex verlaufend. Hinterleib matt. 2·5 mm.	*H. minutus*, n. sp., ♂.
3.	3. Fühlerglied lang und dünn, ca. 3 mal so lang wie das 2. (unten gemessen)........	4.
	3. Fühlerglied kurz und schwer gebaut ..	*H. curticornis*, n. sp., ♀.
4.	Ozellen fehlen. Hinterleib matt	*H. antennatus*, n. sp., ♂.
	Ozellen vorhanden. Hinterleib glänzend .	*H. tasmaniensis*, n. sp., ♂.

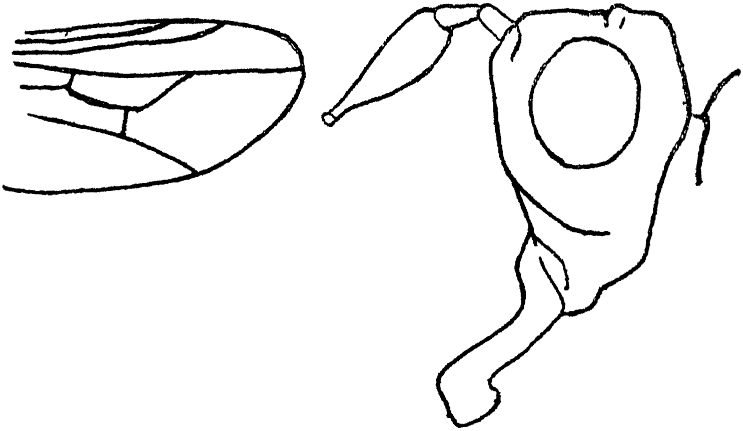
H. minutus, n. sp., ♂, von Victoria. Type: London.

Länge 2·5 mm. Fühler 0·3 mm.; Flügellänge fast 2 mm.

Kleine glänzend schwarze Art vom Typus einer *Chloropide*. Kopf fast viereckig, gelbrot, glanzlos, nach dem

Scheitel zu in Schwarz übergehend. Stirn gefurcht. Fühler schwarzbraun. Gesichtsgruben nicht heller als das Untergesicht. Rüssel gelb. Hinterkopf oben schwarz, unten gelb. Ozellenhöcker deutlich. Augen fast kreisrund. Thorax glänzend schwarz. Schüppchen und Schwinger gelb. *p* gelbbraun. Spitzen der *f* und Tarsen bräunlich. Flügel bräunlich hyalin, stark irisierend. Geäder wie in der Zeichnung. Stiel der 1. Hinterrandzelle etwas länger als diese selbst. Hinterleib matt olivbraun, nur das Analsegment glänzend. 1.–4. Ring gleich breit, 5. etwas erweitert.

Fig. 14.



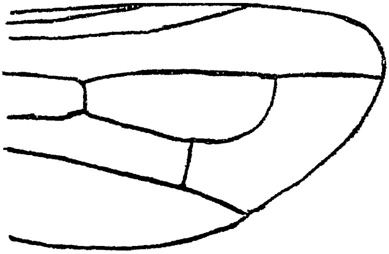
Heteroconops minutus, n. sp., ♂.

H. tasmaniensis, n. sp., ♂, von Tasmania, Hobart, 27. ix Type: London.

Länge fast 6 mm. Fühler fast 1 mm.; Flügellänge 3 mm., -breite 1 mm.

Vom Aussehen einer *Occemyia*. Aehnlich *H. minutus*. Kopf genau so, nur die Fühler sind schlanker. Rüssel schwarzbraun. Stirn grösstenteils schwarz, nur oberhalb der Fühler rotgelb; gefurcht. Ozellen deutlich. Am Augenrand unten etwas silberschimmernd. Thorax glänzend schwarz, zwischen den Schulterbeulen etwas silberschimmernd, an den Pleuren ein Fleck silbern. *p* und Vorderhüften gelbbraun; p_3 und alle Tarsen etwas dunkler, braun. Schüppchen und Schwinger blassgelb. Flügel grauhyalin, stark irisierend. 1. Hinterrandzelle mehr gerundet, der Stiel kürzer als die Zelle. Abdomen glänzend schwarz. Behaarung ziemlich dicht, schwarz. Hinterkopf oben schwarz, unten spärlich goldgelb. In der Paratype kommt aus der Discalzelle noch ein Aderanhang heraus, parallel zur 3. Längsader.

Fig. 15.



Heteroconops tasmaniensis, n. sp., ♂. Flügelspitze.

H. antennatus, n. sp., ♂, von Yanchep, N. of Perth, 3.–19. xii. Type: London.

Länge 5 mm. Fühler 1 mm.; Flügellänge 3·5 mm., -breite 1·1 mm.

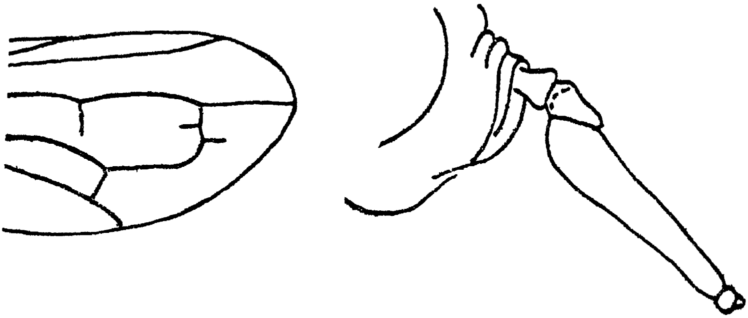
Gleicht in allem *H. tasmaniensis*, aber der Ozellenhöcker fehlt. Rüssel schwarz mit gelben Lippen. Fühler schlank, dunkelbraun, wie bei *tasm.* Thorax wie dort. *p* hellgelbbraun. f_3 mit schwärzlichem Spitzenring. f_1 und f_2 mit unklarem Wisch auf der Oberseite. Pleuren weissschimmernd. Schüppchen weiss. Schwinger hellgelb. 1.–4. Tergit matt olivbraun, 5. und 6. glänzend schwarz. 2. und 3. am Hinterrand fein weiss schillernd. Flügel wie bei *tasm.*; scheinen abnorm zu sein, da in beiden Flügeln aus der 1. Hinterrandzelle je ein Anhang nach innen und einer nach aussen entspringt. Stiel kaum halb so lang wie die Zelle. Flügel sehr stark irisierend.

H. curticornis, n. sp., ♀, Yanchep, N. of Perth, 3.–19. xii. Type: London.

Länge 5·5 mm. Fühler fast 0·5 mm.; Flügellänge fast 3 mm., -breite 1·1 mm.

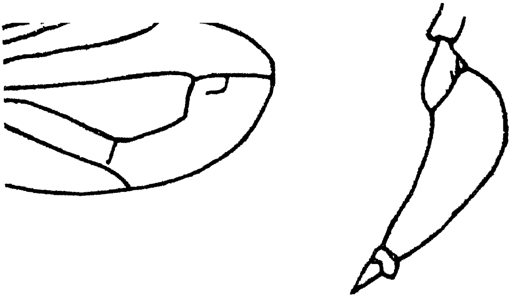
Kopf wie bei den andern Arten. Gesichtsgruben schwarzbraun mit gelbem Kiel. Rüssel schwarz. Scheitel und obere Stirnhälfte tiefschwarz. Ozellenhöcker mit 3 Ozellen. Stirn gefurcht. Untergesicht am Augenrand zart silberweiss. Thorax matt olivbraun, nur an den Schulterbeulen und Pleuren etwas silberschimmernd. Vorderhüften und *p* gelbbraun, f_{1+2} oben mit unklarem Wisch an der Spitze. f_3 und t_3 in der Spitzenhälfte braunschwarz. Tarsenspitzen schwärzlich. Schwinger und Schüppchen blassgelb. Flügel hyalin, stark irisierend. 1. Hinterrandzelle abgerundet, Stiel mit hakenförmigem Aderanhang, in beiden Flügeln gleichmässig. Stiel ca. halb so lang wie die Zelle. Hinterleib sehr dünn und

Fig. 16.



Heteroconops antennatus, n. sp., ♂. Flügelende, Fühler.

Fig. 17.



Heteroconops curticornis, n. sp., ♀. Fühler, Flügelende.

schlank. mattschwarz, mit feinen weissen Hinterrandsäumen am 1.–3. Tergit. Theka klein, dornförmig, hellgelbbraun mit schwarzer Spitze.

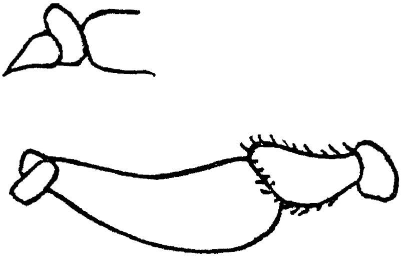
DELKESKAMPOMYIA, gen. nov.

Nächste Verwandte von *Heteroconops.* Rüssel kaum kopflang, schwarz, fleischig. 1. Hinterrandzelle wie bei *Conops,* wenngleich ziemlich lang gestielt. Scheitelblase mit Ozellenhöcker und 2 Ozellen. Stirn gefurcht. 3. Fühlerglied ca. doppelt so lang wie das 2. Endgriffel 2-gliedrig. Abdomen ziemlich schlank. Behaarung sehr zart, aber ziemlich lang.

D. fasciata, n. sp., ♂, von W. Australien, Marloo Stat., Wurarga, viii.–ix. Type: Berlin.

Länge 4 mm. Fühler unter 1 mm.; Flügellänge 3 mm., -breite über 1 mm.

Fig. 18.



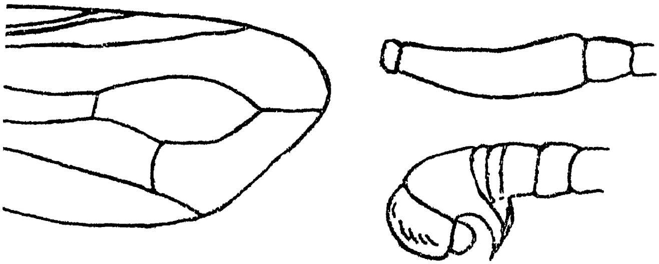
Delkeskampomyia fasciata, n. sp., ♂. Fühler.

Scheitelblase und Hinterkopf oben schwarzbraun. Stirn quergefurcht, am Augenrand mit schwarzer Schwiele wie *Callosiconops,* Partie über den Fühlern und Untergesicht gelbbraun, unten fast weissgelb, auch Gruben und Kiel. Ohne jeden Silberglanz. Rüssel so lang wie die Mundhöhle, schwarz, mit grossen fleischigen Lippen. Fühler kurz, schwarz. 1. Glied kaum länger als breit; 2. doppelt so lang wie das 1.; 3. doppelt so lang wie das 2. Der Griffel scheint 2-gliedrig zu sein. Brustseiten, Schildchen, Hinterrücken schwarz mit zartem Silberglanz durch unendlich zarte Behaarung. *p* schwarzbraun, *t*-basen gelbbraun. Tarsen schwarz. Alles ±weisslich bereift. Schwinger gelb. Flügel ganz hyalin, ziemlich stark irisierend; Geäder wie bei *Conops*. Abdomen ziemlich schlank, schwarz, etwas glänzend; 2. und 3. Tergit mit silberglänzendem Hinterrand, an den Seiten verbreitert, 4. mit Spuren davon. 2. und 3. Ring fast gleich lang, beide etwas länger als breit, 4. oben fast ebenso lang, 5. und 6. bedeutend kürzer. Ich nenne die Art Herrn Dr. Delkeskamp zu Ehren.

SMARTIOMYIA, gen. nov.

Gleicht im Bau *Heteroconops*, hat aber einen langen, dünnen Rüssel, ca. 1½ mal kopflang. Fühlergriffel nicht gut erkennbar (eingliedrig ?) Kopfbehaarung ziemlich lang und dicht, am Körper und den *p* ist die Behaarung lang. Flügel wie bei *Physocephala*, aber mit langem Stiel der 1. Hinterrandzelle wie bei *Heteroconops*. 2. und 3. Tergit ca. um die Hälfte breiter als lang, 4. und 5. schmal ringförmig. 6. so lang wie 3–5 zusammen, stark glänzend. Analsegment gleich lang wie das 6., glänzend. Theka lang und dornförmig, unterhalb der Spitze stark quergeriefelt.

Fig. 19.



Smartiomyia obscura, n. sp., ♀. Flügelende, Fuhler, Abdomen.

S. obscura, n. sp., ♀, von Yallingup, S.W. Australien, 14. ix.–31. x. Type: London.

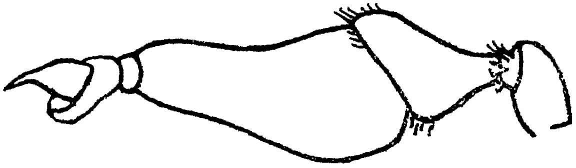
Länge 4·5 mm. Fühler fast 1 mm.; Flügellänge fast 4 mm., -breite 1·5 mm.

Untergesicht rotgelb, am Augenrand silberglänzend. Rüssel 1½ mal kopflang, schwarz, dünn, an der Basis gelb. Fühler ziemlich schlank, schwarz. Stirn und Scheitel schwarzbraun, gefurcht. Ozellenhöcker deutlich. Kopfbehaarung dicht, lang, gelbbraun. Hinterkopf oben schwarz, unten gelbbraun. Thorax und Schildchen dicht, schwarz behaart. *p* schwarz, Knie gelb. *f* stark behaart. Schwinger und Schüppchen gelb. Flügel hyalin, stark irisierend. 1. Hinterrandzelle lang gestielt, Stiel fast halb so lang wie die Zelle. Hinterleib ziemlich plump, matt olivbraun, nur 5. und 6. Segment glänzend schwarz. Theka ziemlich gross, dornförmig, schwarzbraun. 2. Tergit mit schmalem, silberweissem Rand. Längenverhältnisse der Tergite wie oben angegeben. Behaarung, namentlich gegen das Ende zu, lang und dicht. Ich nenne die Art Herrn Dr. John Smart zu Ehren.

CHRYSIDIOMYIA, gen. nov.

Die Weibchen erinnern durch den Körperbau ganz ausserordentlich an die Hymenopteren-Gattung *Chrysis*. Bei allen Arten scheint der Thorax dunkel gefärbt zu sein, das Abdomen leuchtend rotgelb. ♂ im Verhältnis zum ♀ schlank gebaut. Kopf rundlich wie bei *Conops*. Fühler mit grossem Endglied, das etwa doppelt so lang ist wie das 2. Endgriffel 3-gliedrig wie bei *Conops*, das Endglied spreizt stark aus dem 2. heraus. Flügel wie bei *Conops* mit langer 1. Hinterrandzelle. 2., 3. und 4. Abdominalsegment nahezu gleich lang und gleich breit. Tarsen mit gelben Klauen und Haftläppchen, die von gleicher Länge sind.

Fig. 20.



Chrysidiomyia rufa, n. sp. Fühler.

Chr. rufa, n. sp., ♂♀, Yallingup, S.W. Australien, 14. ix.–31. x. Type: London.

♂. Lange 10–12, ♀, 9·5–14 mm. Fühler 1 mm.; Flügellänge 6 mm., -breite 2 mm.

♂. Kopf rotgelb, glanzlos, nur am Augenrand unten etwas silberweiss. Ueber den Fühlern ein unscharfer roter Längsstrich. Scheitel mit schwarzem Ozellenhöcker, der 3 rote Ozellen trägt. Rüssel 1½ mal kopflang, schwarz, ziemlich stark. Fühler tiefschwarz. Hinterkopf oben schwarz, unten gelb; Behaarung ziemlich lang, aber äusserst zart, schwarz. Thorax im Grunde glänzend schwarz, vorn dicht gelbgrau tomentiert, so dass 5 schmale schwarze Längsstriemen bleiben. Behaarung dicht, zart, schwarz. Schildchen glänzend schwarz. Hinterrücken und Pleuren schwarz, grau tomentiert. Schwinger, Schüppchen, *p*, Hüften rotgelb. f_3 und t_3 mit schwarzen Spitzen, ihre Tarsen schwarz, die andern braun, letztes Glied auffallend lang hell behaart. Haftläppchen so lang wie die Klauen, gelb, letztere mit schwarzen Spitzen. Flügel hyalin. stark irisierend, Geäder wie bei *Conops*. Hinterleib schlank. 1. Tergit schwarz, der Rest leuchtend rotgelb, matt. Bauch, Seiten und Analsegment goldgelb tomentiert. 2.–5. Ring mit dunklen Einschnitten. Genitalien rotgelb. Behaarung am 1.–3. Ring seitlich lang zart rotgelb, sonst kurz schwarz.

♀. Gleicht dem ♂, robuster gebaut. Thorax intensiver gelbgrau tomentiert. *p* fast ganz gelb, nur die Spitzen der t_3 etwas schwärzlich. Hinterleib gleich breit gebaut. 1.–4. Tergit oben ±braunschwarz verdunkelt. Hinterränder schwärzlich, Genitalien rotgelb, Spitzenpartie schwärzlich. Theka rotgelb, lang, dornförmig, länger als das Analsegment; unter der Spitze sehr dicht kurz schwarz beborstet und fein lang schwarz behaart.

C. pulchella, n. sp., ♂, von S.W. Australien, Yallingup, 1.–2. Dez. Type: London.

Länge 10 mm. Fühler 1·5 mm. Flügellänge 6 mm., -breite 2 mm.

Gleicht *rufa*, das 3. Fühlerglied ist aber länger. Thorax, Schildchen, Hinterrücken glänzend schwarz ohne Schillerstriemen. Nur bei Seitenansicht ist der Thorax grauübergossen. Pleuren schwarz, silbergrau schimmernd. Schwinger, Schüppchen gelb. *p* nebst Hüften rotgelb. f_3 und t_3 mit breitem schwarzem Apikalfleck. Alle Tarsen schwarz. Haftläppchen und Klauen gleichlang, gelblich. Flügel wie bei *C. rufa*, bräunlich, die 1. Längsader gelb. 1., 4. und 5. Ring tiefschwarz, seitlich gleich dem ganzen Rest des Abdomen, leuchtend rotgelb, matt. 2.–5. Ring am Hinterrand mit Spuren weissen Schimmers. Bauch und Analsegment mit Spuren von Goldtoment.

CALLOSICONOPS, gen. nov.

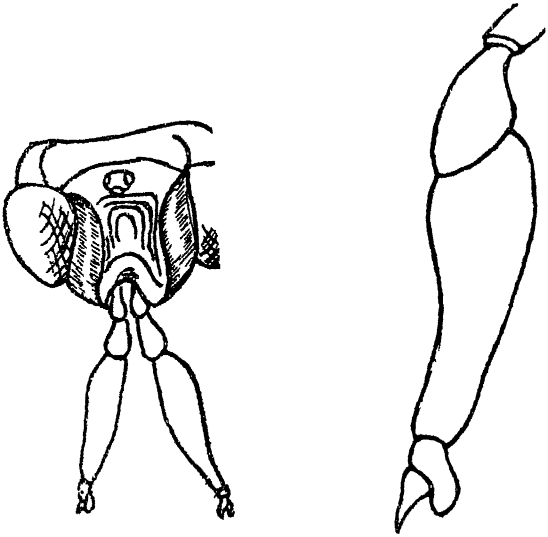
Kopf viereckig. Stirn und Scheitel flach. Beide am Augenrand mit einer glänzend schwarzen Schwiele, die am Scheitel schmal beginnt und am Auge neben den Fühlern breit endet. Scheitelblase schmal, mit Ozellenhöcker, der 3 Ozellen trägt. Stirn gefurcht, auch die Schwiele wird durchzogen. Fühler ziemlich schlank. 1. Glied doppelt so lang wie breit; 2. wenig länger als das 1.; 3. ca. doppelt so lang wie das 2., mit 2-gliedrigem Endgriffel. Untergesicht fast wagerecht, Backen daher sehr schmal. Rüssel in der Ruhelage in der Mundhöhle verborgen, mit ziemlich fleischigen Lippen. Hinterkopf, Thorax und Abdomen ziemlich lang und dicht abstehend behaart. Flügel wie bei *Conops*. *p* ziemlich stark. Haftläppchen so lang wie die Klauen. Hinterleib ziemlich robust, parallelrandig. 2. Ring quadratisch, 3. etwas kürzer; der 4. noch kürzer, der 5. kaum halb so lang wie der 4. 6. Ring so lang wie der 3. und 4. zusammen. Theka gross, dornförmig.

C. hirsutus, n. sp., ♀, von S.W. Australien, Yallingup, 14. ix.–31. x. Type: London.

Länge 8·5 mm. Fühler 1 mm.; Flügellänge 5 mm., -breite fast 2 mm.

Kopf fast viereckig. Stirn flach. Untergesicht fast wagerecht, hellgelb, am Augenrand silberglänzend. Gruben und Kiel gelb. Rüssel kurz, schwarz. Fühler schwarz, 3. Glied an der Basis rotgelb schimmernd; 2. dicht grau tomentiert und kurz schwarz beborstet. 1. tiefschwarz. Stirn gelbrot, gefurcht, seitlich von der glänzend schwarzen Schwiele begleitet, auf die die Furchen übergehen. Augen etwas länger als breit, ziemlich vorgequollen. Scheitelblase schmal, gelbbraun, mit deutlichem, schwarzem Ozellenfleck, der 3 Ozellen trägt. Hinterkopf oben schwarz, unten weissgelb, ziemlich dicht lang schwarz behaart, am Augenrand silberschimmernd. Backen sehr schmal, Partie neben der Mundöffnung fast blasig vorgequollen. Thorax schwarz, gleich Schildchen und Hinterrücken etwas glänzend, mit wenig bemerkbarem Silberschimmer an Schulterbeulen, Hinterrücken, Pleuren und Hüften. Hüften bräunlichgelb, am hellsten die Vorderhüften. *p* gelbbraun, weisslich bereift, vollkommen matt; Oberseite der *f* verdunkelt. Behaarung ziemlich lang, zart, schwarz. Haftläppchen gelbbraun. Klauen rotbraun mit schwarzen Spitzen. Schwinger und Schüppchen weisslich. Stiel bräunlich. Flügel grauhyalin, Geäder wie bei *Conops*. Abdomen robust, fast parallelrandig, schwarz, glanzlos. Hinterränder des 1.–5. weissschillernd; 6. grau tomentiert, 7. teilweise rotgelb, an der Basis etwas glänzend. Theka gross, dornförmig, weiter vorstehend als die Abdominalspitze, gelbbraun, nach der Spitze zu verdunkelt, unten schwarz, lang fein abstehend schwarz behaart. Abdomen oben gegen das Ende zu ziemlich lang und dicht schwarz behaart.

Fig. 21.



Callosiconops hirsutus, n. sp. Kopf von oben, Fuhler.

MICROCONOPS Krb.

1. Schwarze Art mit intensiver goldgelber Abdominalbandierung und Thoracalfleckung. Pleuren mit Silberzeichnung. 7 mm. .... *M. ornatus* Krb.
   Arten ohne Goldtoment .... 2.
2. Thorax glänzend schwarz, ohne helle Striemung. Nur die Schulterbeulen und ein Fleck zwischen ihnen sind silbern ... 3.
   Thorax mit den Anfangen von gelblichen oder silberweissen Striemen .... 4.

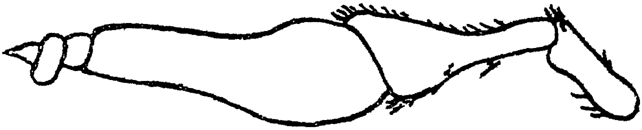
3.	1. Fühlerglied doppelt so lang wie breit. Fühler lang, tiefschwarz	*M. nigrithorax*, n. sp.
	1. Fühlerglied so lang wie breit. Fühler kurz, braun	*M. brunnicornis*, n. sp.
4.	Die Striemenanfänge sind breit mit den Schulterschwielen und dadurch mit den Streifen der Pleuren verbunden	*M. fasciatus* Krb.
	Die Striemenanfänge stehen ganz isoliert	5.
5.	1. Fühlerglied doppelt so lang wie breit	*M. atricornis* Krb.
	1. Fühlerglied kaum länger als breit	6.
6.	3. Fühlerglied unten ± braunrot. Fühler plump	*M. similis*, n. sp.
	3. Fühlerglied ganz schwarz. Fühler schlank	*M. tasmaniensis*, n. sp.

M. nigrithorax, n. sp., ♂♀, von Yallingup, 14. ix.–31. x. Type: London.

♂. Länge 7·5–8·3 mm. Fühler 1–1·4 mm.; Flügellänge 5·4–6·5 mm., -breite 1·6–fast 2 mm.

♀. Länge 5–8 mm. Fühler fast 1–1·2 mm.; Flügellänge 3·2–5 mm., -breite 1·1 mm.

Fig. 22.

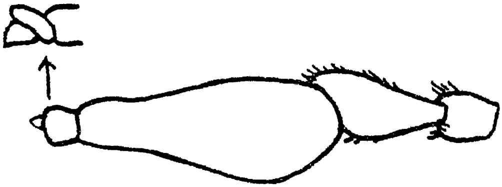


Microconops nigrithorax, n. sp. Fühler.

♂. Untergesicht, einschliesslich Gruben und Kiel, weissgelb, am Augenrand silberschimmernd. Scheitel und Stirn rotgelb. Fühler tiefschwarz. 1. Glied mindestens doppelt so lang wie breit. 2. etwas länger als das 1. 3. um die Hälfte länger als das 2. Griffel 3-gliedrig. Rüssel dünn, schwarz, ca. 1½ mal kopflang. Lippen ziemlich dick. Ozellenhöcker glänzend schwarz mit 2 rotgelben Ozellen. Hinterkopf glänzend schwarz, unten weissgelb, am Rande silberschimmernd, sehr zart schwarz behaart. Thorax glänzend schwarz. Schulterbeulen, Seitenplatten des Hinterrückens, Strieme der Pleuren silberglänzend. Behaarung zart, schwarz. Schüppchen und Schwinger weissgelb. Flügel grauhyalin, starke irisierend. Geäder wie bei *Conops*. *p* schwarz; Kniee und *t*-basen rotgelb; Tarsen schwarz, 2. T. etwas rotgelb. Hüften schwarz, silberschimmernd; besonders die vordern und hintern. *f* und *t* weisslich tomentiert. Hinterleib schlank, schwarz, etwas glanzend. 2.–6. Ring fast von gleicher Lange; 1. breiter als der 2. 6. Ring mit fast kreisrundem Silberfleck. Behaarung zart schwarz. Alle Tergite mit silbernem Seitenfleck, der am 2.–4. zu einer Binde wird. Haftlappchen gelbbraun, Klauen rotbraun mit schwarzer Spitze.

♀ gleicht in allem dem ♂. 1. Fuhlerglied ca. 2½ mal so lang wie breit. Hinterleib robuster, 2. und 3. Ring gleich lang; 4. und 5. bedeutend kürzer. 1.–4. matt oliv schwarzbraun; 5.–6. glanzend schwarz. Behaarung länger, zart. Theka gross, dornförmig, schwarz, bedeutend länger als die Analspitze des Abdomens.

Fig. 23.



Microconops brunnicornis, n. sp., ♀. Fuhler von der Seite.

M. brunnicornis, n. sp., ♀, von Kalamunda, S.W. Australien. Type: London.

Länge 4 mm. Fühler 0·8 mm.; Flügellänge 3 mm., -breite fast 1 mm.

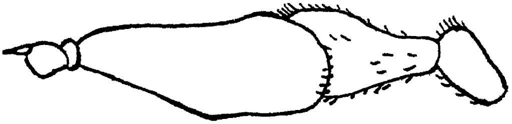
Untergesicht, Gruben und Kiel hellgelb, am Augenrand weissschimmernd. Stirn und Scheitel rotgelb. Scheitelblase gelb. Ozellenhöcker glänzend schwarz mit 2 Ozellen. Rüssel kurz, kaum 1½ mal kopflang, schwarz. Fühler hellbraun; 1. Glied kaum etwas länger als breit. 2. doppelt so lang wie das 1.; 3. ca. doppelt so lang wie das 2., ziemlich breit. Endgriffel scheint 2-gliedrig zu sein, unklar, das Endglied ganz klein. Hinterkopf oben schwarz, unten weiss, Behaarung schwarz. Thorax glänzend schwarz, innerhalb und unterhalb der Schulterbeulen ein kleiner Silberstrich. Pleuren schwarz mit breiter Silberstrieme. Schwinger, Schüppchen gelb. Flügel hyalin, Geäder wie bei *Conops*. *p* dunkelbraun, *t*-basen und Metatarsen gelbbraun. Hüften schwarzbraun, etwas silbrig. Hinterleib schwarz mit bräunlichem Ton, wenig glänzend, nur 5. und 6. Ring stark glänzend; 2. und 3. mit Silberbinde. Theka gross, dornförmig, gelbbraun, unten an der Spitze schwarz.

M. similis, n. sp., ♂, von Yallingup, S.W. Australien, 14. ix.–31. x. Type: London.

Länge 5·1 mm. Fühler 0·8 mm.; Flügellänge fast 4 mm., -breite 1·1 mm.

Kopf ganz rotgelb, Augenrand unten mit Silberschiller. Ozellenhöcker schwarzbraun mit 2 rotgelben Ozellen. Rüssel 1½ mal kopflang, schwarz. Fühler schwarz, 3. Glied braun, wenigstens unten braun schimmernd. Endgriffel 3-gliedrig. Hinterkopf oben schwarz, unten gelb. Thorax schwarz, glänzend. Schulterbeulen gelblich schimmernd, desgleichen ein Strich innerhalb. Seitenplatten des Hinterrückens weisslich schimmernd. Pleuren mit unklarer weisslicher Strieme. Hüften braunschwarz, weissschimmernd. *p* schwarzbraun, *t*-basen gelbbraun. Schwinger, Schüppchen gelblich. Flügel hyalin, Geäder wie bei *Conops*. Abdomen schwarz, ziemlich schlank. Behaarung lang, zart, schwarz. Nur Ring 6 und 7 sind glänzend; 2. und 3. mit Silberband am Hinterrand; 6. ±gelb schimmernd.

Fig. 24.



Microconops similis, n. sp., ♂. Fuhler.

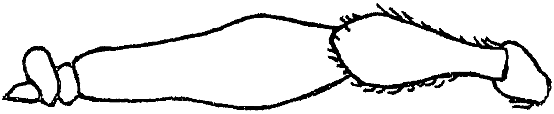
M. tasmaniensis, n. sp., ♂, von Tasmania, Bagdad. Type: London.

Länge 5 mm. Fühler fast 1 mm.; Flügellänge 3·5 mm., -breite 1·1 mm.

Kopf ganz dunkelrotgelb. Augenrand mit Silberschein. Ozellenfleck schwarzbraun mit 2 rotgelben Ozellen. Rüssel kaum 1½ mal kopflang. Fühler schwarz, Griffel 3-gliedrig, bedeutend schlanker als bei *M. similis*. Hinterkopf oben schwarz, unten gelb. Thorax schwarz.

Schulterbeulen mit den Anfangen von 2 feinen Linien innerhalb, gelblich. Partie vor dem Schildchen zementgraugelb, desgleichen die Seitenplatten des Hinterrückens. Pleuren mit breiter Silberstrieme. Hüften silberschimmernd. *p* schwarz. Basalhalfte der *t* gelbbraun. Schwinger, Schüppchen gelblich. Flugel glashell, stark irisierend. Hinterleib schwarz, matt. 2.–4. Ring mit Silberschimmer am Hinterrand, besonders seitlich. 6. Ring mit gelblichem Toment.

Fig. 25.



Microconops tasmaniensis, n. sp., ♂. Fuhler.

Es liegt mir jetzt die erste *Myopa*- und die erste *Stylogaster*-Art von Australien vor.

Myopa ornata, n. sp., ♂, von Sandringham, Victoria. Type: Dahlem.

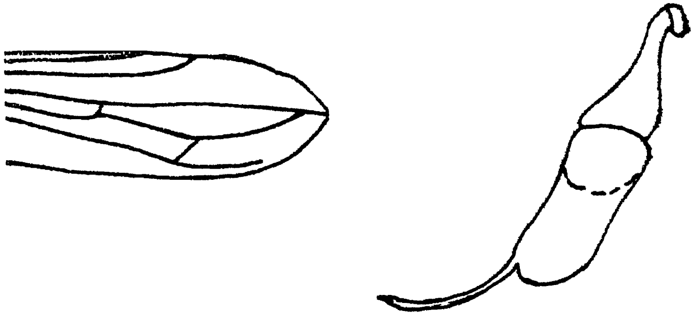
Länge 6·5 mm. Körper ganz warm rotbraun, glanzlos. Kopf mit weisslichen, sehr zarten und ziemlich langen Haaren, die keinen eigentlichen Backenbart bilden. Schimmer weisslich, sehr zart. Gesichtsgruben glänzend gelb. Ozellenfleck glänzend schwarz. Fühler sehr kurz, rotbraun. 1. Glied so lang wie breit, kaum etwas länger; 3. so lang wie das 2., tiefschwarz, mit rotgelbem Basalfleck und schwarzer Borste. Rüssel kurz, schwarz, jedes Glied kaum kopflang. Taster schwarz. Thorax glänzend rotbraun, mit dicht, kurz anliegend gelbbraun behaarten Partien, die vollkommen matt erscheinen und die glänzenden Partien als 4 Längslinien erkennen lassen. Behaarung lang, fein, abstehend, schwarz. *p* rotbraun, Spitzen der *f*, und *t* schwarz; Behaarung zart abstehend, schwarz. Schüppchen weiss, Schwinger gelb. Flügel hyalin. 1. Hinterrandzelle offen. Hinterleib rotbraun. 2.–4. Ring mit haarfeinem, weissem Hinterrandsaum, davor seitlich mit weissem Schiller. Behaarung zart, aber ziemlich lang und dicht, schwarz.

Stylogaster papuanus, n. sp., ♂♀. von Papua, Mt. Tafa, 500 ft., iii. Type: London.

Länge 8 mm. Fühler 0·6 mm.; Flügellänge 4·3 mm., -breite 1·8 mm.

♀. Ganz schwarz, ziemlich glänzend. Untergesicht düster gelbbraun, stark silberglänzend. Stirn und Scheitel sammetschwarz, mit grossem, glänzendem Schildchen bis zu den Fühlern, hier abgestutzt. 3 gelbrote Ozellen. Hinterkopf mit 2 langen, schwarzen Seten. Fühler schwarz. 1. Glied sehr kurz, 2. etwas kürzer als das 3., ca. $\frac{2}{3}$ desselben. Borste fast so lang wie das 3. Glied. Rüssel schwarz, ziemlich stark. Hinterkopf schwarz, grau tomentiert. Thorax, Schildchen, Hinterrücken schwarz, glänzend. Schwinger braun, Hüften schwarzbraun. p_1 gelbbraun; f_1 mit schwarzbrauner Stelle nahe der Basis. t und Tarsen bleichbraun, dicht gelb behaart. t_1 an der Spitze mit einem Büschel gelbbrauner Borsten. p_2 viel länger als p_1. f_3 gelbbraun, stark glänzend, in der Mitte bedeutend geschwollen und hier schwarz. t_3 dunkelbraun, in der Basalhälfte hell. Tarsen ziemlich stark, glänzend braun, dicht schwarz behaart. p_2 hell braungelb, f_2 an der Hinterseite der Länge nach mit äusserst zarten, langen, dichtgestellten Haaren. Flügel hyalin, etwas bräunlich, stark irisierend, mit schmaler 1. Hinterrandzelle. Hinterleib schlank, schwarz, etwas metallisch glänzend. Hinterrandbinden am 2.–4. Ring tiefsammetschwarz. Legeröhre so lang wie der

Fig. 26.



Stylogaster papuanus, n. sp., ♀. Fühler, Flügelspitze.

Hinterleib, wenig glänzend. 6. Ring so lang wie der 2.–5. zusammen. 1. Tergit seitlich lang schwarz behaart. Endsegment schwarz behaart. ♂ entspricht ganz und gar dem ♀. f_2 mit dem gleichen Haarsaum. Rüssel wie beim ♀, das 2. Glied sehr zart, mit haarfeinen, gelbbraunen eingerollten Lippen.

(To be continued.)

VI.—*Descriptions and Records of Bees.*—CLXXVIII.

By T. D. A. Cockerell, University of Colorado.

Nomia stanleyi (Cockerell).

N. Nigeria: Zungeru, Nov. 1910 (*J. W. Scott-Macfie*). Male.

This is the same as the Sudan race mentioned in Rev. Zool. Bot. Afr. xxvii. (1935), p. 346.

Nomia rhodacantha Cockerell.

S. Rhodesia: Lonely Mine, 1915, 3 ♂ (*H. Swale*).

There is some variation; one has the end of the abdomen broadly pale red, with strongly dentiform apical corners; in the other two the apical part is dark and the corners are feebly developed. The red mark on mesonotum in front is large and broadly subtriangular. They appear to be all one species, but more material might indicate a racial difference from the type, which came from near Bukavu, Belgian Congo.

Nomia rufitarsis Smith.

Nyasaland: Mlanje, Nov. 21, 1912 (*S. A. Neave*).

Noteriades bicornutus (Friese).

S. Rhodesia: Lonely Mine, 1915, ♀ (*H. Swale*).

Heriades sulcatifrons Cockerell.

S. Rhodesia: Lonely Mine, Nov. 26, 1914, ♀ (*H. Swale*).

Heriades braunsi Cockerell.

S. Rhodesia: Lonely Mine, Dec. 22, 1914, ♀ (*H. Swale*).

This species was described from the male; the present female is referred to it with some assurance. It is very near to *H. sulcatifrons*, but larger (length 10·5 mm.); the clypeus elevated and appearing like a human nose in profile; mandibles very long, with long reddish hair on inner side; frontal sulcus extending only a little way below middle ocellus; wings a little brownish apically; second and third tergites white-ciliate on margin; ventral scopa creamy-white. The wings are very short for the size of the insect, about 5·3 mm.; the first recurrent nervure ends fully twice as far from base of second cubital cell as second from apex.

Halictus obscurescens, sp. n.

♀.—Length about 10 mm., anterior wing 8·3.

Black, including mandibles, legs black, with the small joints of tarsi red, the large and broad second joint of hind tarsi contrasting with the intensely black basitarsus; flagellum obscurely reddish beneath; tegulæ very dark, slightly brownish; head moderately broad; clypeus little produced, shining, with very coarse irregular punctures; supraclypeal area large and dull, but just above it, between antennæ, is a highly polished vertical line; front dull, with no shining line along orbits; vertex dull, but a shining mark at each side of ocelli; hair of head mainly dark fuliginous, but white on cheeks, and the long fringe below clypeus pale; hair of thorax above mainly greyish-fuliginous but posteriorly pale but dull reddish, of pleura also pallid; mesonotum and scutellum entriely dull, under microscope appearing minutely roughened, with dense shallow punctures; area of metathorax large, entirely dull, not even the margin shining. Wings dusky, stigma red, nervures reddish; second cubital cell broad, receiving recurrent nervure a moderate distance from end. Legs with mainly black hair, intense black on outer side of hind tibiæ and basitarsi, but white hair on inner side of hind tibiæ except at base, white hair also at bases of legs. Abdomen dull black, the first tergite shining but hardly polished; margin of first tergite with a linear pale tegumentary band; abdomen thinly hairy, but no hair-bands or spots, apex black. The hind spur has a row of minute nodules, as in *H. gowdeyi* Ckll.

Uganda: N. Ruwenzori, 6000–8500 ft., Nov. 1–2, 1911 (*S. A. Neave*).

Closely allied to *H. fuliginosus* Ckll., but conspicuously smaller, with the mesonotum and area of metathorax entirely dull, the third cubital cell much shorter. It is also near to *H. patriciformis* Ckll., but distinguished by the dull mesonotum and duller first tergite. It closely resembles an ordinary honey-bee superficially

Halictus calviniellus, sp. n.

♂.—Length about 5 mm., anterior wing about 3·6.

Black, slender, with long narrow subclavate abdomen; labrum, narrow apical band on clypeus (with no upward projection), and mandibles except base yellow, the last suffused with reddish; scape all black; flagellum very long, dark above, clear red below; head broad, orbits converging below; face covered with white hair; cheeks and top of head with long dull white hair; thorax with thin but conspicuous white hair; mesonotum and scutellum shining, scutellum not bigibbous; postscutellum without dense hair; area of metathorax unusually long and narrow, slightly shining, the microscope shows strong irregular plicæ, connected by cross-ridges, forming a coarse network, which does not extend to the apical portion, which is minutely tessellate; posterior truncation moderately shining; tegulæ very dark reddish. Wings clear hyaline; stigma pale yellowish with a dusky margin; nervures pale; second cubital cell rather broad, receiving recurrent nervure well before end; third cubital cell not extended apically. Legs black, the tarsi a little rufescent apically. Abdomen without hair-bands, the sutural regions somewhat reddish.

Cape Province: type from Calvinia, Nov. 1931 (*J. Ogilvie*). Others from Doorn R. Falls, Nov. 1931 (*J. Ogilvie*); Calvinia, Nov. 11–16, 1931 (*W. P. Cockerell*); Blaukrans, near Calvinia, Nov. 17, 1931 (*J. Ogilvie*); Van Rhyn's Pass, Nov. 1931 (*L. Ogilvie*).

Allied to *H. parvulinus* Ckll., from Cape Town, but the abdomen is longer and more slender (the first tergite conspicuously narrower), and the area of metathorax does not show the highly polished margin. The abdomen is more distinctly punctured in *H. parvulinus*, and the sculpture of metathoracic area is much denser. *H. dispositellus* Ckll. has the area of metathorax quite different.

Halictus matopiensis, sp. n.

♂.—Length about 7 mm., anterior wing 4·6.

Head and thorax black, abdomen dark brown; clypeus with a cream-coloured apical mark, the upper border of which is convex varying to subangulate; labrum and mandibles black; head broad but face narrowed below, the clypeus strongly projecting; tongue narrow, with a linear apical extension (style of *H. moffati* Ckll., which has clypeus all black); face and front covered with pale grey hair; antennæ not very long for a male, but reaching scutellum, flagellum thick, very obscurely brown beneath; region of ocelli shining; thorax with copious erect pale greyish hair, slightly yellowish dorsally; mesonotum moderately shining on disc, but closely and conspicuously punctured; scutellum shining, not binodose; rather inconspicuous pale hair in front of and behind scutellum, the latter covering postscutellum; area of metathorax narrowly crescentic, glistening, with close-set well-defined plicæ, and the sides beyond the area covered with wrinkles; posterior truncation hardly shining; tegulæ pale fulvous, darkened at base. Wings hyaline, faintly greyish; stigma rather small, very pale yellowish, nervures very pale; second cubital cell narrow, receiving recurrent nervure near end; third cubital large, but not produced apically; femora and base of legs black; tibiæ with a light spot at base (large on hind pair), a pale line posteriorly on front and hind pair, and the front tibiæ dull red anteriorly; tarsi cream-colour, reddened apically. Abdomen with rather broad pale greyish bands of tomentum at bases of tergites, but no apical or subapical bands; hind margins of tergites slightly reddish; apex with a broad but short shining dark plate; beneath the apex is a highly polished area.

S. Rhodesia: Matopo Hills, April 17 to May 1, 1932 (*Alice Mackie, C. P. Harvey*), 5 ♂.

Related to *H. acuiferus* Ckll. & Ireland, differing by the longer flagellum, shorter mentum, smaller tegulæ, and the markings of the tibiæ. It will fall in the subgenus *Oxyhalictus*.

Halictus pastinimimus Cockerell.

Additional specimens are from George, C.P. (*J. Ogilvie*). and Doorn River, Nov. 3 (*J. Ogilvie*). A specimen from Doorn River shows three long spines on the hind spur. The species is certainly very close to *H. hirtulinus* Ckll., and is perhaps most easily separated by the strong longitudinal groove on the mesonotum anteriorly.

Halictus interstitinervis Cameron.

Transvaal: Louis Trichardt, April 4, 1932 (*J. Ogilvie*); Pretoria, Oct. 9–10, 1931 (*J. Ogilvie*).

These have the plicæ on area of metathorax long and irregular. as described by Cameron, but in the following they are short, confined to the basal part of the area: Victoria Falls, Sept. 1931 (*L. Ogilvie, J. Ogilvie*); Natal, Durban, Oct. 14–18, 1931 (*J. Ogilvie*). All are females. Seen under a lens, the area of metathorax has a characteristic appearance in all these specimens, semicircular, shining, with the centre of base opaque. The Victoria Falls and Durban specimens have dusky wings. It is perhaps probable that two species are involved, but I hesitate to separate them without more evidence. The species is allied to *H. plicatinus* Ckll. and to *H. tanganus* Ckll.

Halictus pulchritarsis, sp. n.

♂.—Length about 6 mm., anterior wing 4·6.

Black, including clypeus. mandibles, and labrum; head broad, nearly circular seen from in front, the clypeus hardly produced; clypeus short, shining, distinctly punctured; supraclypeal area large, shining; front dull, somewhat shining next to eyes at upper end; flagellum long, submoniliform, chestnut-red beneath; hair of head and thorax white, thin; mesonotum and scutellum polished, the mesonotum with an inconspicuous linear groove in front; scutellum flattened on disc, not bigibbous; postscutellum without dense hair; area of metathorax dull and granular, with no shining apex, the microscope shows the surface to be covered with vermiform rugæ, forming a sort of network; posterior truncation dull, sharply margined at sides; tegulæ very dark reddish. Wings hyaline, stigma large, brown; nervures pale brown; second cubital cell narrow above, receiving recurrent nervure shortly before end; third cubital broad, but not extended apically. Legs shining black, with the tarsi entirely bright ferruginous. Abdomen robust, shining, without hair-bands or spots, the hind margins of tergites not discoloured; apex broadly rounded.

Natal: Drakensburg National Park, March 3–15, 1932, 3 ♂ (*J. Ogilvie*).

By the appearance of the legs this suggests *H. layardi* Ckll., but that has a yellow band on clypeus and many other differences. The red tarsi also suggest *H. harveyi* Ckll., which differs by the dull mesonotum and other characters.

Halictus rhodesi, sp. n.

♀.—Length about 7 mm., anterior wing 5.

Black including mandibles and antennæ, but tegulæ pale, with a shining light reddish boss; hair of head scanty, of thorax more abundant, tinged with reddish above, a long fringe behind scutellum, and postscutellum covered with dense pale tomentum; head broad, but the clypeus rather produced; the head is remarkably flat as seen from the side, the cheeks little developed, and the middle of face depressed; clypeus and supraclypeal area shining; front dull, with a shining line along orbits; mesonotum dullish, not polished, very finely and closely punctured, the median groove distinct; scutellum small, dullish, with very fine punctures; area of metathorax crescentic, not very large, appearing dull and granular under a lens, with no shining margin; the microscope shows the area to be weakly defined, pointed behind, the surface minutely rugulose, irregularly reticulate, the extreme base with a row of very short plicæ on a rugulose surface, while the metathorax beyond the area shows fine radiating plicæ on a dull ground; posterior truncation shining, sharply defined at sides. Wings dusky hyaline, stigma and nervures very pale yellowish; outer recurrent and intercubitus very weak; second cubital cell broad, receiving recurrent nervure not far from end; second recurrent far from end of third cubital cell. Legs dark, with pale fulvescent hair, golden on inner side of basitarsi; the tibiæ and tarsi are brownish rather than pure black; hind spur nearly simple, rather as in *H. subvittatus* Ckll., but the very slender apex red and curved. Abdomen broad, enlarged apically, dull, without hair-bands or spots, but with very fine thin greyish pubescence, that on the fourth and fifth tergites reddish orange, and the apex red.

S. Rhodesia: Matopo Hills, April 17–30, 1932 (*J. Ogilvie*).

A very distinct species, on account of the red apex of abdomen to be compared with *H. terminalis* Smith, which has the flagellum rufo-testaceous beneath, and the tarsi ferruginous. They seem to be closely allied. *H. marshalli* Ckll., with tergites 3 to 5 yellowish-haired, is much larger.

Halictus tenkeanus Cockerell.

Katanga: Biano (*L. Ogilvie*), ♀.

Halictus retigerus, sp. n.

♀.—Length about 7·5 mm., anterior wing 5·5.

Black including mandibles, flagellum faintly brownish beneath, tegulæ very dark brown, legs black; hair of head and thorax scanty, dull white, tomentum on scutellum conspicuous; head broad, the clypeus hardly produced; clypeus dull, with fine punctures, and a transverse row of very large punctures below the middle; supraclypeal area entirely dull; front very rough, somewhat shining on each side of middle, conspicuously so when seen from below; mesonotum dull and very rough all over, the microscope showing a very fine but strong reticulation; scutellum entirely dull; area of metathorax crescentic, somewhat shining, with strong plicæ, connected by numerous cross-plicæ, producing a network; posterior truncation dull. Wings dusky, stigma large, dark brown, nervures rather dark brown, first recurrent joining second cubital cell some distance before end; third cubital cell very broad on marginal; hind spur without spines or lamellæ. Abdomen broad, shining, first tergite with white hair at sides, second and third with greyish basal bands, fourth and beyond covered with pale greyish hair, the effect almost bluish.

S. Rhodesia: Shangani, De Beers Ranch, May 11–12, 1932 (*Alice Mackie*).

A peculiar species, separated from its apparently nearest relatives thus :—

	Mesonotum with distinct punctures	*jonesi* Ckll. (Zululand.)
	Mesonotum wrinkled or reticulate	1.
1.	Fourth tergite thinly covered with pale hair ; region on each side of antennæ shining ...	*retigerus* Ckll. (Zululand.)
	Fourth tergite not so covered ; head entirely dull	*rugicollis* Friese.

I have not seen *H. rugicollis*, and have to depend on Friese's short description, but apparently the species is distinct from ours.

Halictus semidiversus, sp. n.

♀.—Similar in almost all respects to *H. diversus* Smith ; mandibles with a red band in middle ; head broad, with thin cinereous hair, pale red on vertex ; clypeus and supraclypeal area polished, the clypeus with a triangular area in middle on which are a few large punctures ; whole front hairy ; vertex dull ; flagellum very obscurely brownish beneath ; thorax with thin cinereous hair, short and reddish dorsally ; mesonotum dull, the posterior disc a little shining and distinctly punctured, anterior median groove very distinct ; scutellum with two shining elevations ; postscutellum with rather abundant pale reddish hair (white tomentum in *H. diversus*) ; area of metathorax large, little shining, with fine dense striæ, easily seen under a lens ; tegulæ shining black. Wings strongly dusky, stigma small, dark brown, nervures dark ; second cubital cell broad ; first recurrent nervure meeting intercubitus ; length of anterior wing 6·3 mm. Legs black, with the small joints of tarsi red, hair on inner side of hind tarsi light bright ferruginous ; hind spur dark, without spines. Abdomen broad, moderately shining, first tergite with pale hair at extreme sides, but no definite spots, second to fourth with rather narrow greyish-white basal hair-bands, third and fourth with rather broad apical bands of cinereous tomentum ; apex with very pale, slightly reddish, hair (black in *H. diversus*).

Cape Province : Ceres, Feb. 12–18, 1932 (*Alice Mackie*).

Related to *H. diversus* Smith, which comes from Natal, but evidently distinct, though possibly no more than a subspecies. There are various superficially similar species: *H. trimeni* Ckll. is separated at once by the lack of conspicuous punctures on second tergite; *H. deceptus* Sm. by the shining mesonotum and shorter area of metathorax; *H. prominens* Ckll. by the very dark wings and strongly reddened margins of caudal furrow; *H. politescens* Ckll. by the shining mesonotum and dull clypeus; *H. placatus* Ckll. by the shining mesonotum and polished scutellum. In *H. semidiversus* the apical middle of first tergite is finely punctured to the end; in *H. latior* Ckll., also found at Ceres, it is polished, hardly punctured.

Halictus leonis, sp. n.

♀.—Length about 6·8 mm., anterior wing 5·5.

Black, robust, with very broad short abdomen, its width about 2·3 mm.; head rather broad, but clypeus prominent; mandibles black, a little reddish subapically; flagellum very obscurely brownish beneath; clypeus and supraclypeal area exposed, intense black, very highly polished; front covered with long greyish hair; vertex shining; hair of head and thorax greyish white, with a long fringe behind scutellum, and tomentum on postscutellum; mesonotum polished, with small punctures, the median groove very distinct; scutellum shining, with a slender longitudinal median groove; area of metathorax crescentic, with a thick feebly shining margin; the microscope shows the area to be minutely reticulate; tegulæ very dark brown. Wings clear hyaline; stigma very pale reddish; nervures very pale, outer recurrent and intercubitus weak; second cubital cell square; first recurrent nervure meeting intercubitus. Legs dark, slightly brownish, hair on inner side of tarsi pale golden; hind spur with many short oblique slender spines (style of *H. deceptus* Sm.). Abdomen with margins of tergites inconspicuously pallescent, dull whitish on third and fourth tergites, the surface thinly clothed with short pale hair, giving a greyish appearance, but no trace of basal bands or spots; the hind margins of the tergites are thinly hairy, but without distinct bands; apex with white hair, reddish at sides of caudal furrow; a conspicuous patch of white hair at apex beneath. The hind legs, and basal half of abdomen beneath, carry much yellow pollen.

Cape Town : Lion's Head, Dec. 12, 1931 (*J. Ogilvie*).

Known by the broad greyish abdomen ; it may be compared with *H. communis* Smith, which has a brownish shining abdomen and a striated area of metathorax.

ERRATUM.—*Haplomellita* ("Bees," CXLVIII. 1934) should be *Haplomelitta*. It is correctly given in "Bees," CLXIII. 1937.

VII.—*Notes on Fossorial Hymenoptera.*—XLVIII. *New Guinea* Thynnidæ *collected by Miss Cheesman.* By ROWLAND E. TURNER.

Thynnus olivaceus Turn.

Thynnus olivaceus Turn., Proc. Linn. Soc. N.S.W. xxxiii. p. 251, 1908. ♂.

♀.—Black ; the front with a broad, transverse band, rounded above, not reaching the eyes ; scutellum with a broad, posterior band ; a lateral spot on each side of tergites 2–5, a broad transverse band, very narrowly interrupted in the middle, near the apex of tergites one and three, two spots on the head beneath, a transverse band on the first sternite, a band deeply emarginate posteriorly on the second sternite, and a spot on each side of the fourth sternite yellow ; the mandibles in the middle, scape, apex of the pygidium and the tarsi fusco-ferruginous ; calcaria and spines of the tarsi fulvous.

Clypeus short and broadly truncate at the apex, shining, with a few large punctures ; head more than half as broad again as long, the front shallowly depressed on each side above the base of the antennæ, the inner margin of each depression bordered by a carina, these carinæ converge and almost meet above the apex of the clypeus, the space between the carinæ divided by a longitudinal sulcus, a space above the depressions and along the inner side of the carinæ closely and rather coarsely punctured, the punctures setigerous, vertex and the remainder of the front smooth and shining, with a few small and scattered punctures. Pronotum nearly twice as broad as long, covered with coarse, setigerous punctures ; scutellum and propodeum shining, with a few scattered punctures, the propodeum oblique, broadened from the base. First tergite coarsely punctured, the punctures setigerous, the basal declivity smooth, apical margin raised, a few irregular transverse striæ on each side before the apex; second tergite with many (12 or more) transverse carinæ, those at the apex high and well defined, those at the base lower and more irregular; tergites 3–5 and sternites 1–2 shining, with a few scattered punctures, sternites 3–4 coarsely and rather sparsely punctured, fifth sternite closely longitudinally striated. Pygidium strongly constricted at the base, with well-defined arched carinæ from base to near the apex, expanding apically into smooth chitinous spaces. Scape distinctly bent beyond the middle; legs clothed with pale hairs, tarsal ungues bifid.

Length 18 mm.

Hab. Papua, Kokoda, 1200 ft., September and October. 1933, ♂♀ in cop.; Dutch New Guinea, Cyclops Mts., Sabron, 930 ft., April to June, ♂♀ in cop.; New Guinea, Mandated Territory, Atape, October to November, 1936, 1 ♂.

The female is quite distinct from *T. calvus* Turn.. the sculpture of the head being very different. The margins of the apical sternite are very delicately serrate in both species, as also in several other Austro-Malayan species. This peculiarity does not occur in Australian species of the genus.

Zaspilothynnus cheesmanæ, sp. n.

♂.—Black; tergites with a greenish sheen; clypeus, inner orbits of the eyes and a small spot on each side between the antennæ yellow; mouth parts, except the mandibles, brown; wings fusco-hyaline, darker in the radial and cubital cells; nervures dark fuscous. Pubescence grey, scanty, except on the mesosternum.

Clypeus closely punctured, the punctures more or less confluent longitudinally, broadly truncate at the apex. Interantennal prominence broad, finely and very closely punctured and divided by a low longitudinal carina; head less closely and rather more strongly punctured, with a small smooth space behind each of the posterior ocelli. Thorax opaque, very closely, but finely punctured, the scutellum subcarinate longitudinally in the middle. Dorsal surface of the propodeum scarcely longer than the metanotum in the middle, the posterior slope oblique. Abdomen shining, sparsely punctured, more closely on the sternites than on the tergites; seventh tergite broadly rounded at the apex, longitudinally striated, with punctures between the striæ; sixth sternite with a spine on each side at the apical angles. Hypopygium broadly triangular, a spine on each side at the base and a stout apical spine.

The nervure branching inward from the first transverse cubital nervure is unusually well developed and almost reaches the stigma.

Length 26 mm.

Hab. Dutch New Guinea, Cyclops Mts., Mt. Lina. 3500 ft., March, 1936.

This seems to be most nearly related to *Z. excavatus* Turn. from N. Queensland, but the propodeum in that species is concave on the posterior slope and shows a shorter dorsal surface, also differing in the colour of the apical tergites.

Epactiothynnus abductor Sm.

Thynnus abductor Sm., Journ. Proc. Linn. Soc. Zool. viii. p. 78, 1865. ♂.
Thynnus candidus Sm., Descr. New Spec. Hym. p. 171, 1879. ♂.
Thynnus papuanus Cam., Nova Guinea, ix. p. 187, 1911. ♂.
? *Thynnus lævissimus* Sm., Journ. Proc. Linn. Soc. Zool. viii. p. 77, 1865. ♀.

I consider that colour differences are not of specific importance in this species. The legs are black in *abductor* and *papuanus*, ferruginous in *candidus*, but intermediate forms occur in which the colour is fusco-ferruginous. The yellow markings are very variable, one specimen having the abdomen entirely black.

♀.—Black; head, antennæ, pygidium, tibiæ and tarsi fusco-ferruginous; apical margins of the tergites narrowly luteous.

Head shining, with a few scattered punctures, a large and deep depression on each side above the base of the antennæ, broader in the middle than long gradually narrowed posteriorly and rounded at the posterior angles. Pronotum opaque, distinctly broader than long, with a deep depression on each side near the posterior margin; dorsal surface of the propodeum as long as the scutellum, sparsely punctured, the posterior slope oblique. Abdomen smooth, with a few scattered punctures, second tergite with four strong transverse carinæ, fifth sternite rugose-punctate, pygidium elongate-ovate, truncate at the apex, received in a deep emargination of the fifth tergite.

Length 7–9 mm.

Hab. Dutch New Guinea, Cyclops Mts., 930 ft., April and May, 1936. Papua, Kokoda, 1200 ft., April to October, 1933, ♂♀, in cop.

A small series of both sexes taken.

The depressions on the pronotum are characteristic of the species. Should this female prove to be identical with *lævissimus*, that name, having page priority, must be used for the species.

Neozeleboria adelpha, sp. n.

♂.—Black; shining; mandibles at the base, basal two-thirds of the clypeus, inner orbits of the eyes rather broadly, outer orbits narrowly, two spots between the antennæ, the anterior and posterior margins of the pronotum, a spot on the mesonotum near the posterior margin, a small spot on the middle of the scutellum, a transverse band on the metanotum, an oblique spot on the mesopleuræ below the fore wing, another above the intermediate coxa, a large spot on each side at the apex of the propodeum, and an oblique spot on each side of tergites 2–5 yellow; fore and intermediate tibiæ and tarsi and the palpi pale ferruginous; a small spot at the base of the tegulæ pale yellow. Wings hyaline, iridescent, nervures fuscous.

Clypeus truncate at the apex; head, thorax and propodeum finely and closely punctured; abdomen smooth and shining, the seventh tergite rather coarsely punctured. Hypogium cordiform, the apical spine short and blunt.

Length 8–10 mm.

Hab. Papua, Kokoda, 1200 ft., April, 1933, 1 ♂ (*type*); Mondo, 5000 ft., January and February, 1934, 3 ♂♂.

The specimens from Mondo have the yellow markings more or less reduced; in one specimen the yellow markings are entirely absent from the abdomen and thorax, except a narrow interrupted line on the anterior margin of the pronotum; the legs are also much darker.

Very near some of the Australian species of the genus, such as *N. trivialis* Sm.

Species of the genus are much more plentiful in the southern half of Australia than in the northern.

Tachynomyia subfragilis, sp. n.

♂.—Black; flagellum, palpi and tarsi pale ferruginous; abdomen, except the first tergite, bright ferruginous. Wings hyaline, iridescent, nervures and stigma ferruginous. Pubescence grey, rather close on the front and pleuræ, the cheeks with a fringe of long hairs.

Clypeus finely and closely punctured, longitudinally carinate in the middle, produced and narrowly truncate at the apex. Head and thorax closely and more strongly punctured. Abdomen shining, almost smooth, the sides and the sternites with sparse fulvous hairs; seventh tergite sparsely, but rather strongly, punctured. Hypopygium short and broad, with an apical spine and a short spine on each side.

Length 8–11 mm.

Hab. Papua, Kokoda, 1200 ft., May and September, 1933.

Closely related to *T. fragilis* Sm., from Morty; differing in the total absence of the yellow marks on the clypeus, front, pronotum, tegulæ, and postscutellum. The legs in *fragilis* are said to be ferruginous, not the tarsi only.

Tachynomyia evelinæ, sp. n.

♂.—Black, with grey pubescence; calcaria and spines of the tarsi testaceous, the three apical abdominal segments, the apex of the fourth tergite, and sternites 2–4 at the apex dark ferruginous red. Wings hyaline, nervures fuscous.

Clypeus finely and closely punctured, produced and narrowly truncate at the apex, convex, indistinctly subcarinate in the middle. Head and thorax, except the pronotum, more strongly punctured, the punctures on the front more or less confluent. Pubescence close and rather long on the sides of the clypeus, pleuræ and propodœum, the cheeks with a fringe of long hairs. Abdomen subpetiolate, the first segment half as long again as its apical breadth, tergites and sternites shining and almost smooth, seventh tergite rather strongly punctured and thinly clothed with fulvous hairs. Hypopygium broad, the apical spine blunt and triangular, the lateral spine on each side short and blunt.

Long. 9–11 mm.

Hab. Papua, Mondo, 5000 ft., January and February.

The colouring is unlike that of any species of the genus known to me.

Tachynomyia flavopicta Rits.

Ælurus flavopictus Rits., Ent. Mag. xii. p. 185, 1876. ♂.

Hab. Dutch New Guinea, Cyclops Mts., Sabron, 2000 ft., June, 1936.

One male.

Originally described from Aru; but is also found in the eastern coast districts of Queensland from Cape York to Tambourine Mountain.

New Guinea does not appear to be rich in *Thynnidæ.* In addition to those collected by Miss Cheesman, the only species recorded are *Thynnus albopilosellus* Cam., *T. calvus* Turn., and *Zaspilothynnus biroi* Turn.

VIII.—*Notes on Fossorial Hymenoptera.*—XLIX. *On new Australian Species.* By ROWLAND E. TURNER.

Family **Mutillidæ.**

Ephutomorpha orphea, sp. n.

♀.—Bronze-black; mandibles, except at the apex, clypeus, a tubercle on each side above the base of the antennæ, scape, first joint of the flagellum, sternum, the lower portion of the pleuræ, legs, and first and second sternites ferruginous; dorsal surface of first tergite, a broad band on the apex of the second tergite, and the middle of tergites 2–6 broadly yellow-brown, clothed with golden pubescence.

Mandibles falcate, not bidentate; clypeus very small, shallowly emarginate apically, the angles forming a minute tooth on each side; second joint of the flagellum distinctly longer than the third. Head and thorax punctured-rugose, coarser on the posterior portion of the thorax, pleuræ shining and almost impunctate. Head no broader than the thorax; the broadest portion of the thorax, a little before the middle, measuring less by one-tenth than the length, the anterior breadth equal to two-thirds of the length, the posterior breadth a little less than five-eighths of the length. Pubescence on head and thorax sparse, blackish above, grey on the sides. Abdomen finely punctured, the yellow-brown portions more finely than elsewhere; sides of the second segment convex. Pygidium without a defined area; hind tibiæ with a few very short black spines.

Length 7–9 mm.

Hab. Tambourine Mountain, S.E. Queensland; April 1935 (*Turner*).

This is closely related to *alata* André and *addenda* André, differing from both in the longer thorax, the greater extent of the coloured portions of the tergites, and other details. Also allied to *rufovariegata* André, but the thorax in the present species is much more abruptly narrowed behind the middle and the coloured markings differ.

Ephutomorpha fulvocrinita, sp. n.

♀.—Reddish brown; covered with pale golden hairs; pleuræ and pygidial area bare; intermediate and hind femora fuscous above.

Mandibles produced into a strong blunt tooth on the outer margin before the middle, bent before the tooth; clypeus bare, finely punctured, truncate at the apex. Second joint of the flagellum as long as the first and third combined. Head finely and rather sparsely punctured; eyes strongly convex. Thorax in front a little broader than the head, measuring on its anterior margin three-quarters of its length, at the broadest point nine-tenths and on the posterior margin three-fifths of its length. Tergites strongly punctured beneath the long hair; second tergite coarsely punctured-rugose; with a longitudinal depression in the middle, not extending to the base or apex. Hind tibiæ with a row of spines on the outer side.

Length 11–12 mm.

Hab. Dedari, 40 miles W. of Coolgardie, W. Australia; January, 1936 (*Turner*), 3 ♀♀.

This is allied to *lutaria* Sm., in which species the mandibles are somewhat similar, but the sculpture in *lutaria* is much finer and the hair is short and close-lying, not long as in this species. In both the pygidial area is finely longitudinally striated. In one specimen the head is almost bare, the hair apparently having been rubbed off, and in a variety the colour of the hair is sandy grey.

Ephutomorpha parca, sp. n.

♀.—Bronze-black; the tergites dark bronze; mandibles in the middle dark ferruginous; three apical joints of flagellum beneath, pleuræ in part, the extreme apex of the propodeal slope, first sternite, sternum, and a narrow line on each side of the first tergite at the apex ferruginous red; a narrow band of white pubescence at the apex of the second tergite, fourth and fifth tergites covered with yellowish grey pubescence and with small tufts of black hair on each side.

Mandibles simple, without teeth; head closely and rather strongly punctured, strongly narrowed and rounded behind the eyes, a low carina on each side from the interantennal tubercles nearly reaching the eyes. Thorax strongly and closely punctured anteriorly, the posterior third very coarsely reticulate, with two small spines on each side of the apical slope; narrowed and rounded anteriorly and rather more strongly narrowed posteriorly, the greatest breadth one-third greater than the breadth at the beginning of the posterior slope and less by nearly one-quarter than the length. First tergite short and narrow at the base; second tergite as long as its greatest breadth, the sides moderately convex, closely, but not coarsely, punctured rugulose. Pygidial area well defined, very finely longitudinally striated. Second sternite rather sparsely punctured.

Length 10 mm.

Hab. Perth, W. Australia, March, 1936 (*Turner*).

This belongs to the group of *amœna* André, which with many allied species of metallic colouring is found in Queensland; this group is very poorly represented in W. Australia, though the South Australian species *E. metallica* Sm. occurs as far north as Dongarra. That species is much more brightly coloured than *parca*, and the sculpture of the thorax is much more uniform, the head also is not strongly narrowed behind the eyes.

Family **Thynnidæ**.

Pogonothynnus morosus Sm.

Thynnus morosus Sm. Descr. New Species Hym. p. 168, 1879. ♂.

♀.—Black; scape beneath, pygidium and tibiæ beneath fusco-ferruginous.

Head shining, moderately convex, finely and very sparsely punctured, about half as broad again as long; thorax very sparsely punctured, pronotum as long as the scutellum and dorsal surface of the propodeum combined, with a row of large setigerous punctures along the anterior margin. Dorsal surface of the propodeum a little shorter than the scutellum and rather more closely punctured, the posterior slope oblique and smooth. First tergite vertically truncate anteriorly, the posterior margin raised, forming a carina, another strong transverse carina behind the middle of the tergite. Second tergite with six transverse carinæ, including the raised apical margin; tergites 3–5 shining, with a few scattered punctures; fourth widely and shallowly emarginate at the apex; fifth very deeply and rather narrowly emarginate, punctured-rugulose on the sides. Pygidium with the smooth parallel-sided dorsal surface received into the emargination of the fifth tergite, with two arched carinæ before the oblique apical slope, which is smooth and broadly triangular. Fifth sternite coarsely longitudinally striated.

Length 10 mm.

Hab. Mingenew, W. Australia, ♂♀ in cop., October, 1935.

Hemithynnus connectens Sm.

Thynnus connectens Sm., Cat. Hym. Brit. Mus. vii. p. 45, 1859. ♀.
Thynnus oppositus Sm., Descr. New Spec. Hym. p. 162, 1879. ♂.

I took a small series of this species at Yallingup, S.W. Australia, in October and November, 1913, differing from the type in the extent of the yellow markings on the second tergite of the female and on the clypeus of the male, but undoubtedly conspecific.

Phymatothynnus aratus, Turn.

Thynnus (Phymatothynnus) aratus Turn., Proc. Linn. Soc. N.S.W. vol. xxxiii. p. 94, 1908. ♂♀.

I took a long series of both sexes in April and May, 1935, at Tambourine Mountain, S.E. Queensland. The male differs from the typical Victorian form in the wholly black colour of the legs, which are ferruginous in the type, and in the reduction or absence of the yellow marks on the pronotum, scutellum and metanotum.

Phymatothynnus victor, sp. n.

♀.—Black; mandibles, thorax, propodeum and apex of the pygidium fusco-ferruginous

Head broader by one-third than long, finely and not very closely punctured, the front widely emarginate above the clypeus and with a small tubercle at each side touching the base of the antennæ, the posterior angles of the head rounded. Pronotum shining, with a few scattered punctures, narrower than the head, a little more than half as broad again as long, with a small tubercle on each side near the middle of the anterior margin; scutellum scarcely more than half as long as the pronotum. Propodeum oblique, with a low convex, subtriangular, space at the base, smooth and shining. Abdomen shining, first tergite rounded at the base, broadened to the apex, almost smooth. Second tergite with two well-marked transverse carinæ at the apex and a less strongly marked one at the base, the space between irregularly, transversely, striate rugose; tergites 3–5 closely and minutely punctured at the base, shining and smooth at the apex. Pygidium ovate, longitudinally striate-rugose at the base, smooth at the apex. Sternites more coarsely, but not closely punctured; the fifth sternite more closely punctured, more finely at the apex than at the base.

Length 6–8 mm.

♂.—Black, with white pubescence, palpi ferruginous. Wings hyaline, faintly iridescent, slightly infuscate in the radial and in the second and third cubital cells.

Head closely punctured, clypeus and front clothed with long white pubescence. Antennæ about half as long as the costa, joints 8–12 strongly arcuate beneath. Thorax and propodeum more sparsely punctured; abdomen shining and almost smooth; first tergite narrow at the base, gradually broadened, longer than the second. Hypopygium broad, without spines, broadly rounded at the apex.

Length 9–10 mm.

Hab. Dongarra, W. Australia, September 26 to October 3, 1935. ♂♀ in cop. 10 pairs taken.

Very near *P. nitidus* Sm., but differs in the much larger hypopygium and in the clouding on the fore wing of the male; and in the distinctly finer punctures of the head and thorax, and in the very much less strongly raised space at the base of the propodeum. The head and thorax are bright ferruginous red in the only specimen I have seen of the female of *nitidus*.

P. pygidiophorus Turn. is more distantly related, differing in the shape of the male hypopygium, and in the pronotum, propodeum and pygidium of the female.

Thynnoturneria xerophila, sp. n.

♂.—Black; tegulæ brown; femora, tibiæ and tarsi bright ferruginous; pubescence sparse, whitish; wings hyaline, nervures fusco-ferruginous; an obscure transverse line on the metanotum ochreous.

Clypeus truncate at the apex, rather thickly clothed with whitish pubescence. Antennæ short, only half as long as the costa. Head, thorax and propodeum finely and closely punctured, more strongly on the scutellum than elsewhere, the anterior margin of the pronotum straight, not emarginate. Tergites 2–6 strongly constricted at the base, finely punctured, the sixth sternite with an acute spine at the apical angles. Hypopygium with three spines, the median spine twice as long as the lateral.

Length 11 mm.

♀.—Head shining, as long as the greatest breadth, compressed posteriorly and very little more than half as wide as between the eyes. Thorax and propodeum smooth and shining, pronotum as long as broad, a little narrower than the posterior margin of the head; dorsal surface of the propodeum as long as the scutellum, the posterior slope oblique. Tergites finely and closely punctured; second tergite with four well-defined transverse carinæ, the spaces between the carinæ smooth. Pygidium long and narrow, a tuft of long curled hairs on each side beneath. Fifth sternite punctured. Sides of the abdomen sparsely clothed with long hairs. Black; fore tibiæ and tarsi fusco-ferruginous.

Length 5–7 mm.

Hab. Dedari, 40 miles west of Coolgardie, W. Australia. ♂♀ in cop. January, 1936. A long series of both sexes. Dongarra, W. Australia, one pair; October 3, 1935.

The male is very near *T. lachrymosus* Turn. and *T. armiger* Turn., differing from both in the colour of the legs, which appears to be constant. In *lachrymosus* the pronotum is shallowly emarginate anteriorly and is margined with pale yellow, the hypopygium also is broader, in *armiger* the anterior margin of the pronotum is also pale yellow, but the hypopygium is narrower and the spines shorter than in *xerophila.* The females of *lachrymosus* and *armiger* are unknown.

Rhagigaster dissociatus, sp. n.

♂.—Black; mandibles, except at the apex, clypeus, inner orbits of the eyes as high as the base of the antennæ, a transverse line, interrupted in the middle between the antennæ, pronotum, tegulæ, an oblique line above the tegulæ, a large mark on the mesopleuræ, a large mark occupying most of the scutellum, a band interrupted on each side on the metanotum, a large spot on each side at the apex of the propodeum, broad apical bands on tergites 1–6, narrower bands, more or less bisinuate anteriorly, on sternites 2–6, femora at the apex, tibiæ above, and the basal joint of the intermediate and hind tarsi lemon yellow. Wings subhyaline, faintly tinged with yellow, nervures ferruginous, costa and stigma pale ferruginous.

Clypeus broad, sparsely punctured, truncate at the apex, without carinæ. Antennæ stout, of almost even thickness throughout, measuring 7½ mm. compared with 9 mm. for the length of the costa. Pronotum rather sparsely punctured, in the middle a little more than half as long as the mesonotum, the remainder of the thorax and propodeum more closely punctured. Abdomen elongate, the segments not constricted, very sparsely punctured on the yellow bands, much more closely on the black portions, microscopically on the basal tergites, much more strongly on the seventh tergite and on the sternites. Seventh tergite long, very narrowly truncate at the apex, deflexed and covering the aculeus of the hypopygium. Tarsal ungues bifid. Second abscissa of the radius as long as the third.

Length 15 mm.

Hab. Southern Cross, W. Australia, January 10, 1936 (*Turner*), 1 ♂.

In colour this is utterly unlike any other species of the genus. In the structure, especially in that of the seventh tergite covering the aculeus, it resembles *R. pyxidatus* Turn. These two species form an aberrant group. The females are unknown.

Family **Scoliidæ.**

Subfamily *Anthoboscinæ*.

Anthobosca aurifera, sp. n.

♀.—Black; mandibles at the base, palpi, scape, first joint of the flagellum and the legs bright ferruginous; sixth tergite fuscous at the apex; a broad band on the pronotum, a large square spot on the mesonotum, a transverse band on the scutellum, a spot below the tegulæ, a spot on each side of the metanotum, and a narrow transverse line in the middle, the posterior slope of the propodeum, and a broad transverse band, interrupted in the middle, near the base of tergites 1–3, bright golden yellow. Wings hyaline, nervures black. Pubescence greyish-white, black on the sides of the pygidium and fifth tergite.

Head shining, front very sparsely punctured, vertex smooth. Thorax and propodeum shining, almost smooth, with scattered punctures on the pronotum, pleuræ more deeply and closely punctured. Pronotum in the middle about equal in length to the mesonotum. Tergites shining, sparsely punctured; pygidium opaque, longitudinally rugulose-striate at the base, smooth at the apex. Sternites more closely punctured, 2–3 with a fringe of grey, 4–5 with a fringe of black pubescence at the apex. Tarsal ungues with a pointed lobe near the base. Second abscissa of the radius scarcely as long as the first, third longer than both combined. First recurrent nervure received at the middle of the second cubital cell, third just beyond one-third from the base of the third cubital cell. Fore wing on the costa nearly three times as long as the breadth of the mesonotum.

Length 13–14 mm.

Hab. Southern Cross, W. Australia; January 10, 1936 (*Turner*). 2 specimens.

Allied to *A. fastuosa* Sm., but in that species the colour extends over the whole pronotum, metanotum, propodeum, and three basal abdominal segments, leaving the mesonotum and scutellum immaculate. The vertex is also subopaque and finely punctured; the fore wing a little shorter, tinged with yellow and with ferruginous nervures.

Family **Sphegidæ.**

Nysson (*Acanthostethus*) *triangularis*, sp. n.

♀.—Black; a short transverse band on each side at the apex of the second and first tergites cream-yellow; wings fusco-hyaline, nervures black.

Clypeus rather sparsely punctured, shallowly emarginate at the apex; head rather finely, thorax and propodeum much more coarsely rugose, basal area of the propodeum strongly longitudinally striated, the spines of the propodeum shining and very strong. First tergite strongly, but not closely, punctured, also the second sternite; second tergite more sparsely punctured, third to fifth tergites very closely and minutely punctured; pygidial area finely rugose, thinly clothed with silver pubescence. Eyes separated on the clypeus by a distance equal to twice the length of the scape, diverging towards the vertex; posterior ocelli half as far again from the eyes as from each other. Second joint of the flagellum nearly as long as the first and third combined. Two cubital cells, the second pointed on the radius; first recurrent nervure received by the first cubital cell at a distance from the apex equal to about half the length of the first transverse cubital nervure.

Length 9 mm.

Hab. Mingenew, W. Australia, October 15, 1935 (*Turner*).

This is larger than any other species of the subgenus except *obliteratus* Turn., to which it is closely allied, differing in the distinctly coarser sculpture of the thorax, in the black colour of the first tergite, which is ferruginous in *obliteratus*, and in the non-petiolate second cubital cell. In both species the sides of the pygidial area are not serrate, and there are no spines at the angles of the tergites. *N. obliteratus* was described from a male, but I have a female before me, taken by me at Perth in February, 1936.

Arpactus (*Miscothyris*) *plomleyi*, sp. n.

♀.—Black ; clypeus, a small spot above the base of the clypeus, the inner orbits of the eyes as high as the base of the antennæ, scape, except at the extreme base, a transverse band on the pronotum, metanotum in the middle, a small spot below the tegulæ, a transverse band, narrowed inwardly and widely interrupted in the middle near the apex of the second tergite, yellow ; tibiæ and tarsi ferruginous ; wings hyaline, nervures fuscous.

Shining, head and thorax finely, abdomen microscopically and very closely punctured. Eyes diverging both towards the clypeus and the vertex, nearest to each other above the base of the antennæ, where they are separated by a little more than the length of the scape, on the vertex by one and one-third of that length and on the apex of the clypeus by two-and-a-half of that length. Clypeus short and broad, two-and-a-half times as broad at the apex as long ; posterior ocelli twice as far from each other as from the eyes. Second joint of the flagellum a little longer than the third. Triangular area at the base of the propodeum smooth and shining ; second sternite convex, sixth tergite narrowly subtriangular, rounded at the extreme apex and thickly clothed with golden brown setæ. First recurrent nervure received by the first cubital cell at a distance from the apex equal to a little more than one-third of the length of the first transverse nervure, second recurrent received at the same distance from the apex of the second cubital cell.

Length 10 mm.

♂.—Similar to the female ; the front, including the margins of the eyes, entirely black, metanotum black, fore tibiæ yellow in front ; the yellow marks on the second tergite reduced to a transverse spot on each side. In both sexes the hind tibiæ are distinctly serrate.

Length 8 mm.

Hab. Barrington Tops, S.E. Australia, January 7, 1934 (*Plomley*).

This is a larger species than the allied forms from Queensland and Western Australia ; the face is considerable broader and the pygidium narrower and with differently coloured setæ. In general appearance it resembles some of the species of *Crabro* of the subgenus *Solenius*, whereas *lucidulus*, from the Queensland coastal

IX.—*New South American* Helotrephidæ (*Hemiptera-Heteroptera*). By W. E. China, M.A., British Museum (Natural History).

Up to the present only a single species of the aquatic family Helotrephidæ has been recorded from the New World. *Neotrephes usingeri* China was described in 1936 * from specimens collected by Mr. Fritz Plaumann in the Brazilian province of Santa Catharina. I have now received from Mr. Plaumann a number of specimens representing two additional species of this genus collected in the province of Rio de Janeiro. At the same time my colleague Dr. H. E. Hinton has very generously allowed me to describe still another new Helotrephid which he collected in French Guiana on his way back from the Cambridge University Lake Titicaca Expedition. Hinton's specimens represent a new genus and species. Before going on to describe the material it is necessary to qualify the existing description of *Neotrephes* in one very important point.

NEOTREPHES China, 1936.

Ann. & Mag. Nat. Hist. (10) xvii. p. 527 (1936).

Additional description :—

At the bottom of page 529 of the above paper attention is drawn to the fact that a fully winged form of *Neotrephes usingeri* occurs in which the claval suture is present and the clavulus is distinctly delimited but without the apical tubercle. It is a pity that the writer did not then examine this specimen more closely. Since that time additional material of *N. usingeri* has been obtained from Mr. Plaumann, including several fully winged specimens. Recent examination of these reveals the extraordinary fact that they possess the normal two-segmented antennæ (fig. 2 *e*) of the Helotrephinæ. This means that within a single species both one-segmented and two-segmented antennæ occur in brachypterous and macropterous adults respectively. It would seem that the larval antennal character persists in the brachypterous form. So far as I am aware no other Hemipteron has a varying number of antennal segments in one species, although

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* Ann. & Mag. Nat. Hist. (10) xvii. pp. 527–538 & 645.

in some other orders with multisegmented antennæ, such as the Orthoptera and Hymenoptera and even in some Coleoptera, such variation may involve a few of the segments.

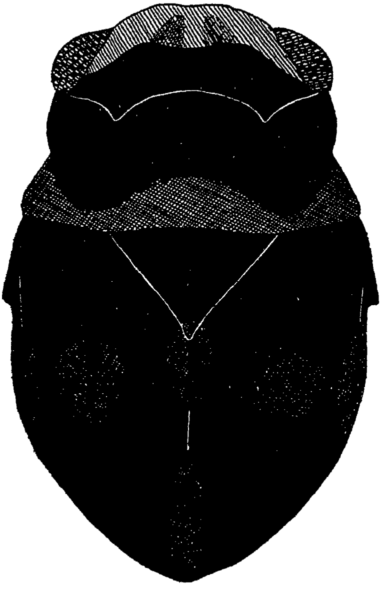
As is usual in macropterous forms the shape of the pronotum is very distinct from that of the normal brachypterous specimen. The venation of the hind wing is identical with that of the Helotrephinæ (*Hydrotrephes bouvieri* E. & C., 'Eos,' iv. no. 2, p. 130, fig. 1 *d*, 1928), and is probably constant throughout the family. In *Neotrephes*, as well as in other Helotrephidæ, there is a curious conical swelling at the base of the subgena which seems to bear at its apex a circular hyaline organ which is apparently sensory. The small size and extreme sclerotization of these insects makes the investigation of such an organ very difficult.

Neotrephes plaumanni, sp. n. (Figs. 1, 2, 3, & 4.)

Colour.—Head dull yellow, basal region behind eyes and in front of cephalonotal suture dull black, the black pigmentation extending right up to posterior inner margins of eyes; a pair of short longitudinal shining brown stripes, placed medially, anterior to front edge of posterior black area of head; eyes moderately shining, brownish black; subgenæ seen from above and lateral keels of head shining black; rostrum sordid yellow at base shading to brown on apical segment. Pronotum dull black, posteriorly with a transverse fulvous band, somewhat narrowed on each side between the posterior lateral lobes and the middle of disk (fig. 1). Scutellum dull black, extreme apex obscurely ferruginous. Pleura dull black, the posterior lateral areas of the propleura obscurely sordid yellow; median sternal keels shining black or sordid yellowish black. Hemielytra dull black, with an elongate stripe on commissure below apex of scutellum, a rounded spot on side of disk, an elongate spot in middle of costal margin extending towards the discal spot and the apical margin rather broadly, all dull ferruginous (fig. 1). Coxæ dull brown, trochanters, femora, tibiæ, and tarsi shining yellow, shading to light brown at extreme apices of femora and tarsi, tarsal claws brown. Venter dull, ferruginous-yellow, the seventh abdominal segment brownish black.

Structure.—Body oval, widest across apex of scutellum, moderately convex, with a very sparse short golden pubescence. Head seen from front well produced in front of eyes, apically narrowed and rounded; seen from above more or less truncate between eyes; surface sparsely punctate, the punctures larger posteriorly; rostrum (fig. 2 *b*) reaching apex of prosternum, relative length of segments, 3 : 5 : 10 : 11. Antenna (fig. 2 *c*) longer than wide, more or less conical, with depressed basally directed bristles on anterior half extending slightly beyond base of antenna; apically with two strong erect bristles. Cephalonotum seen from above about one and three-fifths times as wide across humeral angles as long in the middle, the pronotum in middle to central arch of cephalonotal suture rather less than twice as long as head. Disk of pronotum very strongly and coarsely punctate,

Fig. 1.

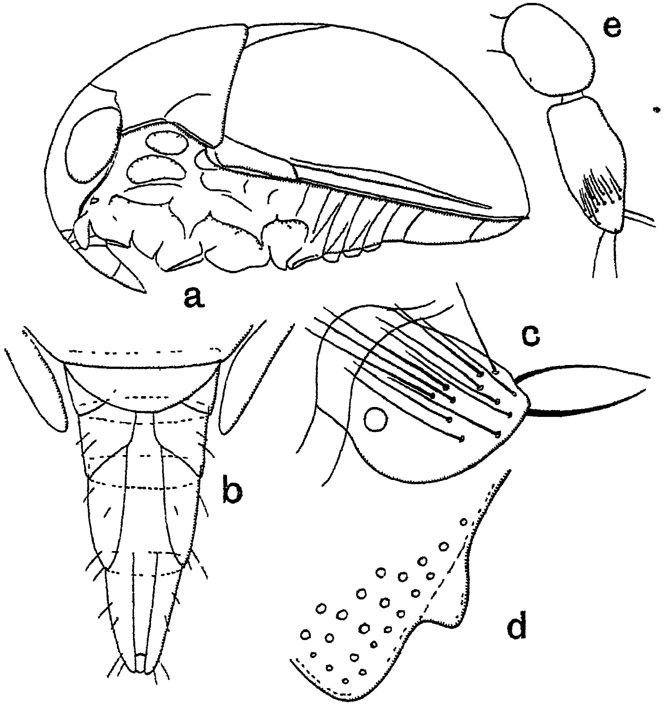


Neotrephes plaumanni, sp. n.

Diagram of dorsal view, to show colour-pattern.

the punctures much finer in region behind eyes. Humeral angles somewhat tumid. Pro-, meso-, and metasternal keels as figured (fig. 4 *d*), the mesosternal keel with its ventral edge broadened and strongly concave. Scutellum rather feebly punctate in basal angles, about one and a half times broader at base than long in middle (35 : 25). Hemielytra (fig. 2 *d*) strongly, regularly punctate, the punctures deepest near basal lateral angles of corium and becoming weaker towards the apices, the right-hand

Fig. 2.



Neotrephes plaumanni, sp. n.

a, lateral view of ♂ without legs, to show position of antenna, structure of pleura, clavulus, lateral hemielytral ridge, rostrum, and ventral carinæ ; *b*, rostrum ; *c*, antenna ; *d*, apex of right hand ♀ hemielytron, to show sensory lobe.

Neotrephes usingeri Ch.

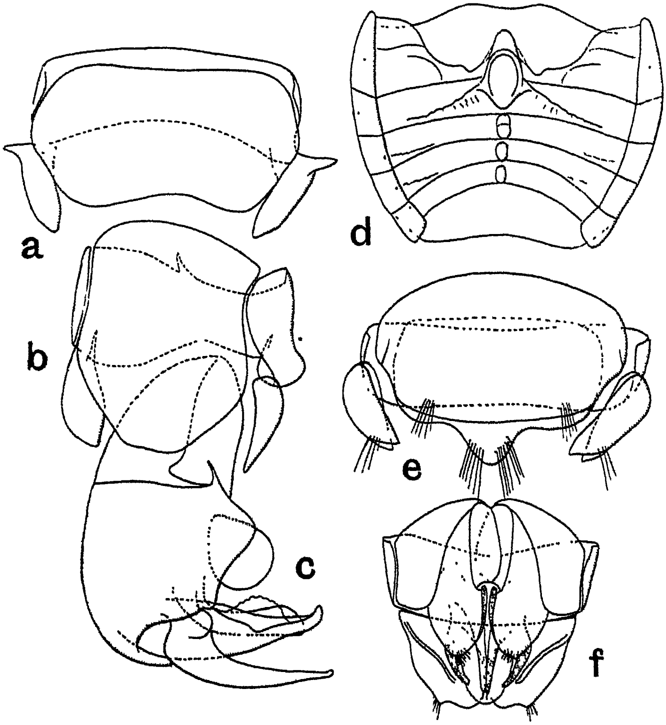
e, two-segmented antenna of macropterous form of adult.

hemielytron in female with a sensory lobe on costal margin. Armature of legs as in *N. usingeri*. Relative lengths :—

	Coxa.	Trochanter.	Femur.	Tibia.	T. 1.	T. 2.	T. 3.	Claws.
Front leg ...	15	14	50	40	3	9	10	8
Middle leg ..	15	15	45	33	4	10	10	6
Hind leg ...	19	18	52	50	4	21	20	9

(70=1 mm.)

Fig. 3.



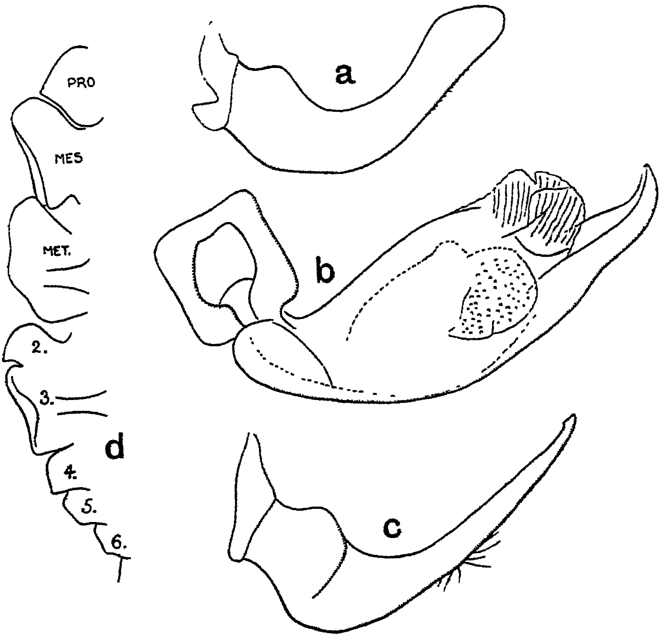
Neotrephes plaumanni, sp. n.

a, ventral view of seventh ♂ abdominal segment; *b*, ventral view of eighth ♂ abdominal segment; *c*, ventral view of ninth ♂ abdominal segment and genitalia; *d*, venter of male, showing carinæ; *e*, ventral view of seventh ♀ abdominal segment; *f*, ventral view of eighth and ninth ♀ abdominal segments, to show ovipositor (only principal bristles shown).

Hind trochanter with a small median tubercle also present in *N. usingeri*, but omitted from the description and figures of that species.

Venter figured (fig. 3 *d*), median process of third abdominal sternite narrower than in *N. usingeri*, that of second sternite distinctly longer. Spiracles almost invisible. Pygophor without a spur. Ædeagus (fig. 4 *b*) more acute apically than in *N. usingeri*. Ventral paramere (fig. 4 *c*) broader at base and without an angular sinuation on its anterior margin. Dorsal paramere (fig. 4 *a*) apically obliquely truncate, rounded at apex, not pointed as in *N. usingeri*. Seventh female ventrite (fig. 3 *e*) as in *N. usingeri*, but with the apical median process much broader. In the figure of the eighth and ninth abdominal segments of *N. usingeri* the pair of internal processes of the eighth sternite shown in dotted lines are much too short. Actually they extend to the apices of the external ventral lobes of the eighth segment.

Fig. 4.



Neotrephes plaumanni, sp. n.

a, dorsal paramere ; *b*, ædeagus with basal plates ; *c*, ventral paramere ; *d*, lateral view of sternal and ventral carinæ.

In *N. plaumanni* these internal processes are much longer, as shown in figure.

Total length 1·84 mm.

Greatest width (across hemielytra at apex of scutellum) 1·28 mm.

Habitat.—Brazil, Province of Rio de Janeiro, Retiro, Petropolis; 6 brachypterous ♂♂ and 7 brachypterous ♀♀ (type and paratypes), end of March (*Fritz Plaumann*).

This species is respectfully dedicated to Mr. Plaumann, who has made known the presence of this family in S. America.

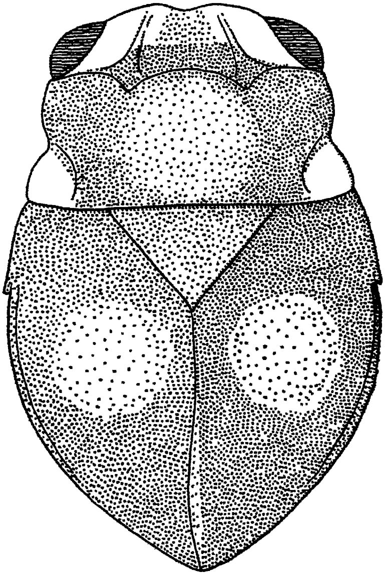
Closely allied to *Neotrephes usingeri*, and differing only in the smaller size, distinct fulvous transverse band across back of pronotum, distinct fulvous spots on hemielytra, different shape of ventral carinæ of thorax and abdomen, slight differences in shape of parameres and ædeagus, and in presence of two stout bristles at apex of antenna. As no macropterous specimens are available it is impossible to say whether the antenna is 2-segmented in such forms of this species.

In studying this species it was noticed that there is a distinct labrum which is apparently present in all Helotrephids. It is broad and rather narrow, as shown in fig. 2 *b*, and was previously missed in descriptions of the family owing to scarcity of material and also to its extreme thinness and semi-translucence. The existence of a labrum in the Helotrephidæ brings the family even closer to the Naucoridæ, and its importance will be discussed later.

Neotrephes jaczewskii, sp. n. (Figs. 5, 6, & 7.)

Colour.—Head yellow, basal region above median sinuation of cephalonotal suture dull black, the black pigmentation as in *N. usingeri* not extending to posterior inner margins of eyes; a more or less percurrent longitudinal shining brown stripe down middle of yellow region; eyes shining brownish black; subgenæ seen from above shining dark brown; rostrum yellowish brown at base, the whole of apical segment dark brown. Pronotum black at anterior lateral angles, shading to ferruginous brown internally; posterior lateral angles fulvous-yellow; disk largely fulvous, the region between the yellow humeral angles and fulvous disk brownish black (fig. 5). Scutellum ferruginous-brown shading to dark brown at base. Pleura dull black, sternal keels shining dark brown. Hemielytron dark brownish black with an obscure almost obsolete round ferruginous spot in middle and apical margin narrowly ferruginous. Coxæ ferruginous-brown, trochanters, tibiæ, and tarsi shining yellow shading to golden-brown towards apices of tarsi. Venter dull greyish brown shading to yellowish on ♀ genital segments and to ferruginous-brown on ♂ genital segments.

Fig. 5.

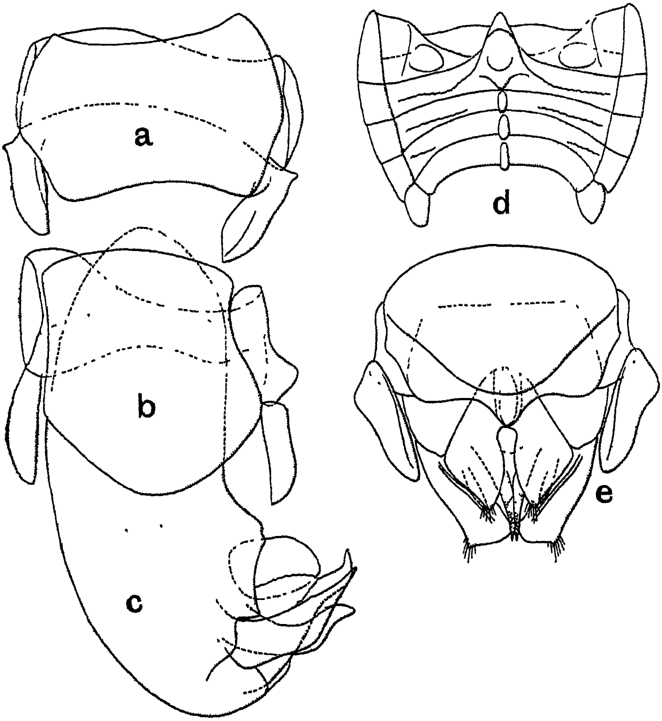


Neotrephes jaczewskii, sp. n.

Diagram of dorsal view, to show colour-pattern.

Structure.—Body oval, widest across apex of scutellum, moderately convex, without or with almost obsolete pubescence. Head seen from front well produced in front of eyes, apically narrowed and rounded; seen from above more or less truncate between the eyes, with a distinct median convex sinuation; surface densely reticulately punctate, the punctures strongest posterolaterally; a broad furrow down middle, widest at base above median sinuation of cephalonotal suture and rapidly narrowing anteriorly and becoming obsolete towards apex of head, the lateral margins of this furrow forming two broad but distinct ridges on base of head, and extending posteriorly into angular sinuation of the cephalonotal suture; rostrum reaching the apex of the prosternal keel, relative lengths of segments 3 : 4 : 12 : 12.

Fig. 6.



Neotrephes jaczewskii, sp. n.

a, ventral view of seventh ♂ abdominal segment; *b*, ventral view of eighth ♂ abdominal segment; *c*, ventral view of ninth ♂ abdominal segment and genitalia; *d*, venter of male, showing carinæ; *e*, ventral view of seventh, eighth, and ninth ♀ abdominal segments (only principal bristles shown).

Antenna oval, larger than wide, strongly convex, with depressed obliquely-posteriorly directed bristles about as long as antenna and extending beyond its margin; apically with two ? erect bristles. Cephalonotum seen from above about one and a half times as wide across humeral angles as long in the middle (93 : 58); the pronotum in the middle to the central arch of cephalonotal suture nearly twice as long as head (40 : 22). Disk of pronotum strongly punctate, especially laterally inside of the somewhat tumid yellow humeral angles; puncturation of anterior lateral area much finer. Pro-, meso-, and metasternal keels as figured (fig. 7 *d*), very similar to those of *N. usingeri*. Scutellum rugosely punctate on basal two-thirds, rather less than one and a half times broader at base than long in middle (43 : 30). Hemielytra strongly regularly punctate, the punctures deepest near basal lateral angles of corium and becoming weaker towards apices; right-hand hemielytron in female without sensory costal lobe. Armature of the legs as in *N. usingeri*. Relative lengths:—

	Coxa.	Trochanter.	Femur.	Tibia.	T. 1.	T. 2.	T. 3.	Claws.
Front leg ...	20	15	58	48	3	10	10	8
Middle leg ..	20	17	53	35	2	10	10	6
Hind leg ...	20	18	60	57	4	23	22	9

(70=1 mm.)

Hind trochanter with a small median tubercle on underside, as in *N. usingeri* and *N. plaumanni*. Venter figured fig. 6 *d*), median process of third abdominal sternite broader than in *N. plaumanni* and narrower and more produced posteriorly; that of second abdominal sternite more acute apically. Pygophor without a spur. Ædeagus (fig. 7 *b*) very similar to that of *N. plaumanni*; ventral paramere (fig. 7 *c*) equally broad along basal three-fourths, then suddenly tapered to a point, the apex not at all barbed, the anterior margin with a small angular sinuation at point where paramere begins to narrow. Dorsal paramere sinuate, gradually tapering to a blunt point, not apically truncate as in *N. usingeri* and *N. plaumanni*. Female genitalia very similar to those of *N. usingeri*, but the seventh ventrite rather more produced apically and without the three very distinct tufts of hairs.

Total length 2·3 mm.

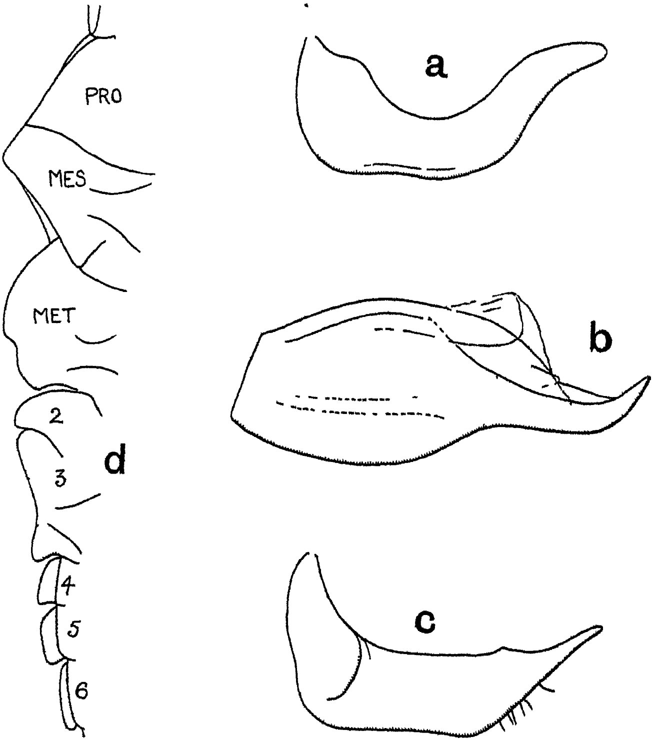
Greatest width across hemielytra 1·5 mm.

Habitat.—Brazil, Province of Rio de Janeiro, Retiro Petropolis; 1 brachypterous ♂ (type), 1 brachypterous ♀ (paratype), end of March (*Fritz Plaumann*).

This species is respectfully dedicated to my friend Dr. T. Jaczewski, the well-known Polish hemipterist, in recognition of his work on the S American aquatic Hemiptera.

Neotrephes jaczewskii is intermediate between *N. usingeri* and *N. plaumanni* in size and colour-pattern. It may easily be distinguished from either by the longitudinal furrow down middle of head and by the broader ventral paramere. It differs from *N. plaumanni* in the absence of a sensory costal lobe on the right-hand ♀ hemielytron, and while agreeing with *N. usingeri* in the absence of a complete posterior pallid band at base of pronotum

Fig. 7



Neotrephes jaczewskii, sp. n.

a, dorsal paramere ; *b*, ædeagus (basal plates not shown) ; *c*, ventral paramere ; *d*, lateral view of sternal and ventral carinæ.

it resembles *N. plaumanni* in having pallid spots on the hemielytra, although these are far less conspicuous than in that species.

PARATREPHES, gen. nov.

Body strongly convex above as in the Helotrephinæ, laterally somewhat compressed, so that the insect is distinctly narrower compared with its height than the average Helotrephid (fig. 8); surface smooth and on disk of cephalonotum and scutellum distinctly shining; cephalonotum, scutellum, and hemielytra feebly and sparsely punctate, the punctures stronger at base of hemielytra; suture between head and pronotum more or less straight, not strongly sinuate as in the average Helotrephinid, and extending on a level with the posterior margins of eyes; cephalonotum relatively long, strongly deflexed as in the Helotrephinæ. Lateral margin of pronotum distinctly concave, its anterior lateral angle very acute, extending on to surface of eye (fig. 9 *a*) more or less as in *Limnotrephes*. Rostrum long and slender, extending to middle of posterior coxæ, the fourth segment the longest and much longer than remaining segments together, the first and second segments subequal, the third about twice as long as the first (fig. 9 *b*). Labrum longer than in *Neotrephes*, quadrangular rather than semicircular (fig. 9 *b*). Antenna placed on ventral side of head, near lateral margin below apical fourth of eye; consisting of elongate-oval rather strongly convex plate attached at one end to the head by a short and cylindrical stalk inserted into under surface of head; both stalk and plate appear to be fused, so that the antenna is one-segmented although it might be said to show an incipient segmentation; the plate with the usual circular sense-organ at the base (stalk end) and with the usual long depressed hairs on the apical half, but also with two strong apical bristles as in *Hydrotrephes* (fig. 9 *c*). Subgena very broad, widened, and truncate at apex, with the posterior angle slightly produced, not visible from above (fig. 9 *a*). No distinct lateral plate; the genal plate separated from the lateral pronotal plate by the propleuron and connected only by a narrow laminate ridge below the eye. Pleural region similar to that in *Neotrephes*. Pro-, meso-, and metasterna represented by well-elevated laminate keels between the coxæ. Lateral margins of the pronotum very finely, almost obsoletely carinate. Scutellum much shorter than broad at base, but relatively longer than in *Neotrephes*, extending almost halfway to apices of hemielytra, and consequently relatively broader at base than in *Neotrephes*. Hemielytra with the clavulus flat as in the Helotrephinids, without the apical projecting tubercle found in *Neotrephes*, the hemielytra laterally without the costal ridge found in that genus; right-hand hemielytron in female without a lobe near apex of costal margin. Legs very similar in armature to those of *Neotrephes*, all the tarsi three-segmented, the basal segment very short, the third longer than second. Second abdominal sternite with a narrow apically pointed median process; third sternite with an apically semiglobular median process, anteriorly produced over that of the second sternite, posteriorly much less elevated and narrowed, projecting beyond posterior margin of third sternite; fourth, fifth, and sixth sternites with small feebly elevated median ridges forming a ventral abdominal carina (figs. 9 *a* & 11 *d*); spiracles very small and difficult to distinguish. Male genital segments similar to those in the Helotrephinæ (figs. 10 *a–c*), the pleural lobes of the seventh and eighth segments long, those of seventh lacking the prominent spurs at bases found in *Neotrephes*; ædeagus very broad apically, neither hammer-headed as in *Hydrotrephes* nor acuminate as in *Neotrephes*, but similar to that found in *Limnotrephes*. Female genital segments (fig. 10 *e* & *f*) similar to those of *Neotrephes*, but the seventh without a distinct median posterior process, and the ventral plates of the eighth segment largely covered at base by lateral sclerites (fig. 10 *f*).

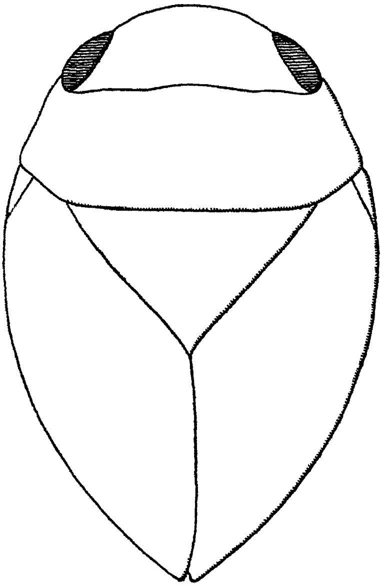
Genotype: *Paratrephes hintoni*, sp. n.

Paratrephes hintoni, sp. n. (Figs. 8, 9, 10, & 11.)

Colour.—Apical third of head yellow, posterior two-thirds dark brown, with an obscure brownish-yellow spot on each side touching posterior inner margin of eye and a larger more obscure area in middle towards posterior margin sordid ferruginous-brown; eyes black, rostrum, subgenæ, and antennæ ferruginous-brown. Pronotum dark brown, with the disk largely obscure ferruginous-brown. Scutellum dark brown, with the whole central area fulvous. Pleura dark brown; coxæ dull dark brown, trochanters, femora, tibiæ, and tarsi shining yellow. Venter dark brown shading to fulvous on apical segments. Hemielytra uniformly dark brown, slightly paler along commissure.

Structure.—Body elongate-oval, widest across middle of scutellum (fig. 8), covered with very short depressed pubescence, and with numerous long erect whitish hairs on head and genital segments, particularly visible in fluid. Head seen from front well produced in front of eyes, apically narrowly truncate; seen from above broadly rounded between eyes; surface dull, obscurely and feebly punctate. Rostrum reaching middle of posterior coxæ, relative length of segments 6 : 4 : 10 : 38. Antennæ slightly more than twice as long as wide, depressed bristles on apical region about as long as antenna is wide, the two erect apical bristles about the same length. Cephalonotum (head and pronotum) seen from above about one and three-quarters times wider across humeral angles than long in middle (83 : 47); pronotum in middle about twice as long as head seen from above (29 : 14).

Fig. 8.

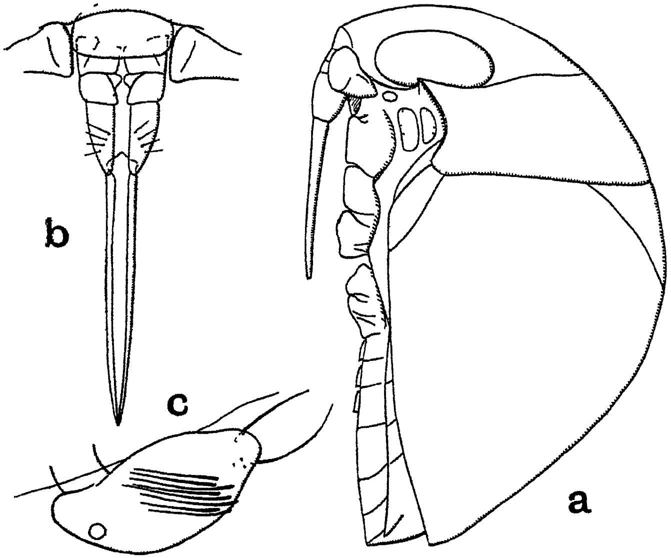


Paratrephes hintoni, gen. et sp. n.

Outline diagram, to show general shape.

Pronotum almost obsoletely punctate, punctures only visible on disk. Pro-, meso-, and metasternal keels as figured (fig. 11 *d*), the mesosternal keel not broadened along its ventral edge. Scutellum practically impunctate, nearly twice as broad at base as long in middle (60 : 36). Hemielytra more strongly punctate, the punctures deepest near the basal lateral angles of corium and becoming weaker towards apex. Relative lengths of legs :—

Fig. 9.



Paratrephes hintoni, gen. et sp. n.

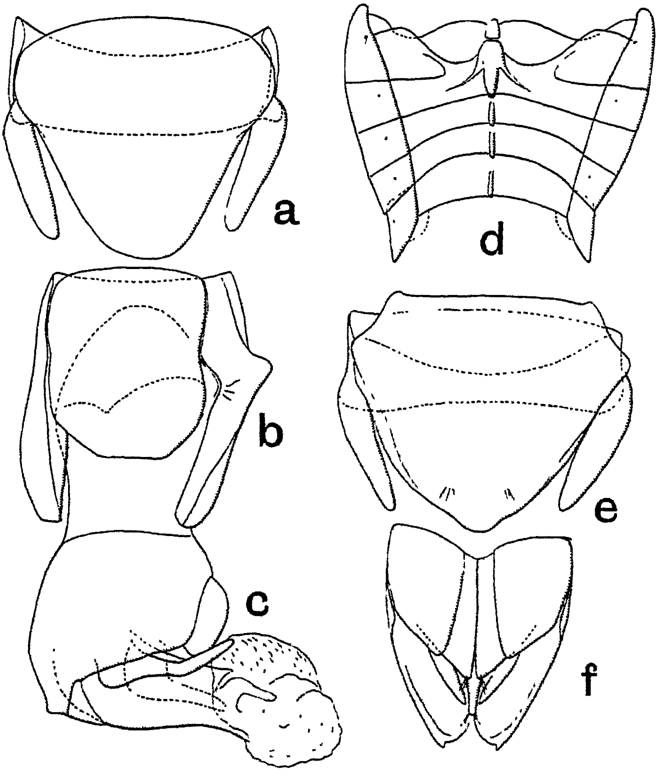
a, lateral view of ♀ without legs, to show position of antenna, structure of pleura, clavulus, rostrum, and ventral carinæ ; *b*, rostrum ; *c*, antenna.

	Coxa.	Trochanter.	Femur.	Tibia.	T. 1.	T. 2.	T. 3.	Claws.
Front leg ...	20	11	41	32	3	8	10	5
Middle leg ..	21	14	40	27	3	8	11	6
Hind leg ...	20	15	41	42	3	15	17	7

(70=1 mm.)

Venter figured (fig. 10 *d*). Male genital segments figured (fig. 10 *a*–*c*) ; ædeagus widening toward apex (fig. 11 *b*), ventral paramere broad at base, more or less suddenly narrowing to a long finger-like process which is bent in the middle upwards (cephalad) and outwards (ventrad), the apex rounded (fig. 11 *c*); dorsal paramere broad on basal half, then bent at right angles into a narrow finger-like process (fig. 11 *a*) with a rounded apex. Seventh female ventrite (fig. 10 *e*) slightly produced posteriorly in middle, but not forming a definite process; eighth and ninth female ventrites figured (fig. 10 *f*).

Fig. 10.



Paratrephes hintoni, gen. et sp. n.

a, ventral view of seventh ♂ abdominal segment; *b*, ventral view of eighth ♂ abdominal segment; *c*, ventral view of ninth ♂ abdominal segment and genitalia; *d*, venter of male, showing carinæ; *e*, ventral view of seventh ♀ abdominal segment; *f*, ventral view of eighth and ninth ♀ abdominal segments, to show ovipositor (only principal bristles shown).

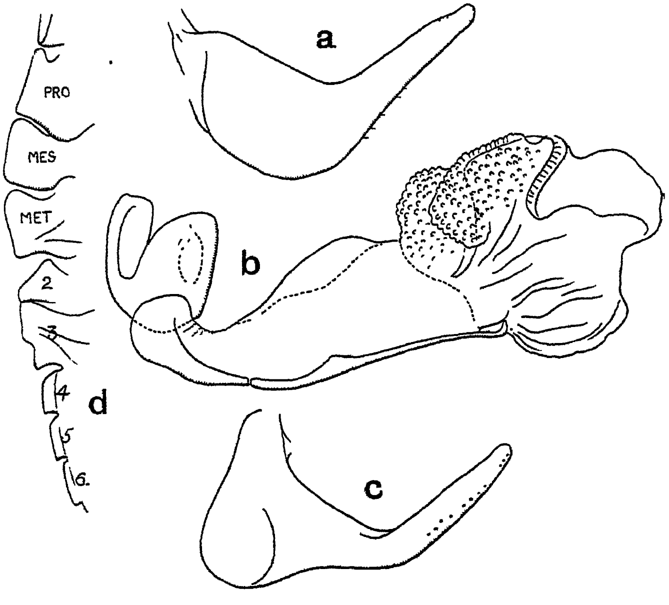
Total length, ♂ & ♀, 2 mm.

Greatest width across hemielytra in middle of scutellum 1·3 mm.

Habitat.—French Guiana, St. Laurent, 25 brachypterous specimens (type and paratypes), October 1937 (*H. E. Hinton*).

This species is dedicated to the collector, my colleague, Dr. H. E. Hinton.

Fig. 11.



Paratrephes hintoni, gen. et sp. n.

a, dorsal paramere ; *b*, ædeagus with basal plates ; *c*, ventral paramere ; *d*, lateral view of sternal and ventral carinæ.

SYSTEMATIC POSITION OF *PARATREPHES*.

The discovery of additional Helotrephidæ in S. America was expected to throw some light on the position of *Neotrephes* in the family classification, particularly as to whether it belonged to the Idiocorinæ or whether it should form a distinct subfamily. Although after preliminary examination it appeared that the new genus *Paratrephes* would be disappointing in this respect, detailed study has fulfilled our expectations. At first sight *Paratrephes*, with its smooth, globular shape and feeble puncturation, appears to be much more closely related to the Helotrephinæ, especially to the Malaysian genus *Hydrotrephes*, with its rather long rostrum, than to either the Idiocorinæ or *Neotrephes*. Closer investigation, however, shows that it is actually nearer to *Neotrephes* than to either the Helotrephinæ or the Idiocorinæ. *Neotrephes* and *Paratrephes* agree in a number of characters in which they differ from all other genera of Helotrephidæ. They can, in fact, be regarded as forming a distinct new subfamily, which I propose to call Neotrephinæ. Although no macropterous forms of either *Neotrephes plaumanni* or *Paratrephes hintoni* are known, it is probable that these when found will exhibit two-segmented antennæ. Although, therefore, this structure cannot at the moment be added to the subfamily diagnosis, if ultimately found to be present in the S. American Helotrephids it would form a valuable subfamily character, since in the Helotrephinæ macropterous forms have the same number (two) of antennal segments as the brachypterous forms. Unfortunately no macropterous forms of the Idiocorinæ are known.

NEOTREPHINÆ, subfam. nov.

Dorsal surface of head separated from ventral surface by a carina more distinct than in the Idiocorinæ; no distinct lateral pronotal plate, connected by a genal plate to the base of subgena, as in the Helotrephinæ, but the pleural area strongly concave, with two distinct longitudinal ridges. Scutellum much shorter than broad at base. Tarsi all three-segmented. Female with subovipositor.

In a previous paper on the Helotrephidæ (Ann. & Mag. Nat. Hist. (10), xv. p. 611, 1935) a key to the family was given. This must now be modified as regards section 1 in the following way :—

1. Adult tarsal segmentation 3—3—3 ; dorsal surface of head separated from ventral surface by a distinct though fine carina ; scutellum much broader at base than long in middle ; female with subovipositor ...	NEOTREPHINÆ, 1 *a*.
Adult tarsal segmentation 1—1—2 ; dorsal surface of head not separated from ventral surface by a distinct carina (or if so, scutellum much longer than broad) ; scutellum at least as long as broad ; female without a subovipositor	1 *d*.
1 *a*. Cephalonotal suture straight between hind margins of eyes ; hemielytra without longitudinal lateral ridge near costal margin ; rostrum long and slender, extending to middle of posterior coxæ ;	

lateral margins of pronotum feebly sinuate, puncturation weak .... *Paratrephes.*

Only the genotype, *Paratrephes hintoni* Ch. (French Guiana.)

Cephalonotal suture sinuate, extending behind margins of eyes; hemielytra with longitudinal lateral ridge near costal margin; rostrum short and thick, not nearly reaching middle of posterior coxæ: lateral margins of pronotum strongly sinuate; puncturation strong. *Neotrephes*, 1 *b*.

1 *b*. Hemielytra entirely dark; right-hand hemielytron in female with a distinct sensory costal lobe. (Brazil, Sta. Catharina.) .... *Neotrephes usingeri* Ch.

Hemielytra with yellow or fulvous markings, the right-hand hemielytron in female with or without a distinct sensory costal lobe .... 1 *c*.

1 *c*. Pronotum with posterior transverse yellow band; hemielytra with several distinct yellow spots; ♀ sensory costal lobe present; dorsal paramere narrowed towards apex; ventral paramere equally broad on basal two-thirds. (Brazil, Rio de Janeiro.) .... *Neotrephes plaumanni* Ch.

Pronotum without posterior transverse yellow band, only humeral angles yellow; hemielytra with a single, indistinct, large, discal, ferruginous spot; ♀ sensory costal lobe absent; dorsal paramere widened towards apex; ventral paramere gradually narrowed from base to apex. (Brazil, Rio de Janeiro.) .... *Neotrephes jaczewskii* Ch.

1 *d*. Body flattened, suture between head and pronotum absent. Antennæ single-jointed .... IDIOCORINÆ.

Body strongly convex, suture between head and pronotum visible. Antennæ two-jointed .... HELOTREPHINÆ.

PHYLOGENY OF *NEOTREPHES* AND *PARATREPHES*.

It was hitherto believed (see 'Eos,' iv. p. 170, 1928) that the evolution of the Helotrephidæ had been one of specialization from the Notonectid type by way of the Pleidæ, and this idea was examined fully in my paper on *Neotrephes usingeri* Ch. (Ann. & Mag. Nat. Hist. (10) xvii. p. 536, 1936). It now appears probable that the reverse may be, at least in part, true. The discovery of a distinct though membranous labrum in the Helotrephidæ, combined with the presence of a single opening of the dorsal abdominal gland in the larva, indicates a much closer relationship with the Naucoridæ than had been previously held possible. The Pleidæ and Helotrephidæ are also more closely related than either family is to the Notonectidæ, as is shown by the presence of sternal and ventral carinæ. the presence of a single opening of the dorsal abdominal gland in the larva, and by the extreme reduction of the antennal segmentation in the larva. Nevertheless the Notonectidæ are definitely more generalized than the Helotrephidæ and Pleidæ, particularly in the four-segmented antennæ, although several genera, such as *Nychia* and *Buenoa,* possess antennæ of only three segments*. The reduction in the segmentation of the antennæ is not, therefore, necessarily due to adaptation to aquatic life, since the Notonectidæ are undoubtedly well adapted to such an existence. The Notonectids, however, are strong fliers, which no doubt accounts for their wide distribution, and it may be essential for them to possess antennæ which are flexible and mobile. In the Pleidæ, and to a greater extent in the Helotrephidæ, the powers of flight are reduced, the winged forms are rarer. It is therefore possible in these groups for reduction of the antennæ to proceed to the greatest extreme. This is shown by the fact that in the entirely aquatic (non-flying) larvæ of both Pleidæ and Helotrephidæ the antennæ are not only single-segmented but even entirely immobile.

The restricted distribution of the Idiocorinæ is no doubt due to the absence or rarity of winged forms, and it is fairly certain that if such are ever discovered they will be found to possess two-segmented antennæ similar to those found in the winged forms of *Neotrephes.* In fact the existence of both one- and two-segmented antennæ in the same species of *Neotrephes* shows how a reduction in antennal segmentation may originally have arisen, and, in view of Dollo's Law as to the irreversibility of any evolutionary line, indicates that *Neotrephes* comes earlier in the evolutionary sequence than the Old World Idiocorinæ, but later than the Old World Helotrephinids in which both macropterous and brachypterous forms possess two-segmented antennæ. On the other hand, the straight suture between the head and pronotum of *Paratrephes* is an indication that *Paratrephes* is less specialized and more primitive than the Old World Helotrephinæ. But *Paratrephes* also shows a greater degree of specialization than the Old World Helotrephinæ in the single-

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* In the wingless form of *Neoplea striola* Fieb. the antennæ are three-segmented as in the fully winged form.

segmented antenna. It seems probable that both *Paratrephes* and *Neotrephes* more closely resemble the primitive proto-Helotrephidæ than do any of the Old World forms, although of course they have become specialized in their own way. The probable evolutionary sequence of the Helotrephidæ and their allies is shown in the table facing this page.

X.—*The Presence of living Ostracods in the Intestinal Tract of* Triturus v. viridescens.

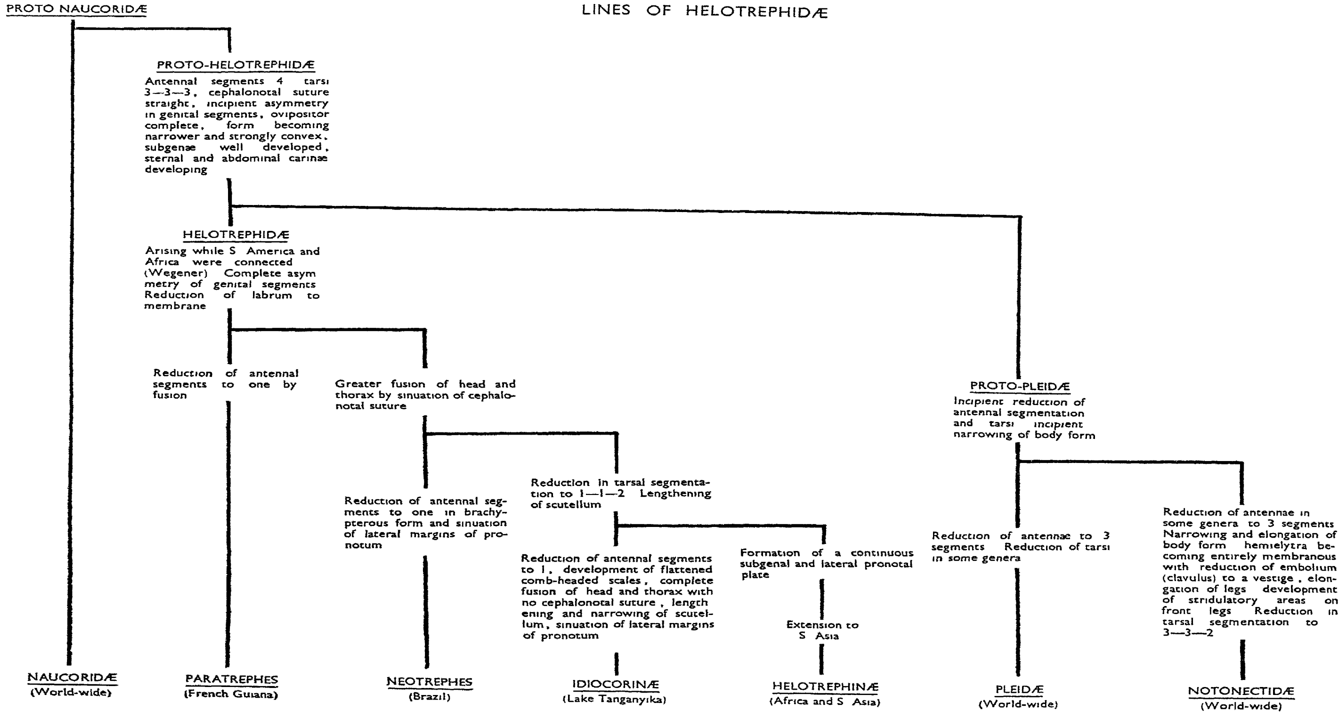
By Donald J. Zinn, Osborn Zoological Laboratory, Yale University, New Haven, Conn.

A phenomenon apparently heretofore unnoted in literature concerning *Triturus v. viridescens* is the occurrence of living ostracods in the upper part of the intestine of that animal.

The ostracods were identified through the kindness of Dr. Norma Furtos as belonging to the species *Cypria elegantula* (Fischer-Lillj.) (=*exsculpta* auct.). The species is a common one, found in Europe, Africa, Asia and South America, as well as being distributed throughout North America.

The *Triturus*, from which the ostracods were taken, were collected from a small shallow pond in the Yale Bird and Flower Sanctuary in West Haven, Conn. The pond itself is moderately productive, having a large population of aquatic insects and insect larvæ, diaptomid and cyclopid copepods, the common isopod *Asellus*, the amphipod *Hyallela*, and the molluscs *Sphærium*, *Lymnæa* and *Physa*. Cladocera have not been noted although undoubtedly present, and the ostracods have shown up rarely in wash-water from the pond. That the ostracods were not found in the few bottom samples taken suggests the idea that they gathered in small clumps in the late fall before the cold weather. Thus, had special towings for these animals been made, considerable populations of them would have probably been found. The pond, an artificial one dammed within the last twenty-five years, has a clay bottom into which washes detritus from the shore and a slight amount of silt and other materials from the small inlet—itself a drainage stream for the surrounding area.

TABLE SHOWING PROBABLE EVOLUTIONARY
LINES OF HELOTREPHIDÆ

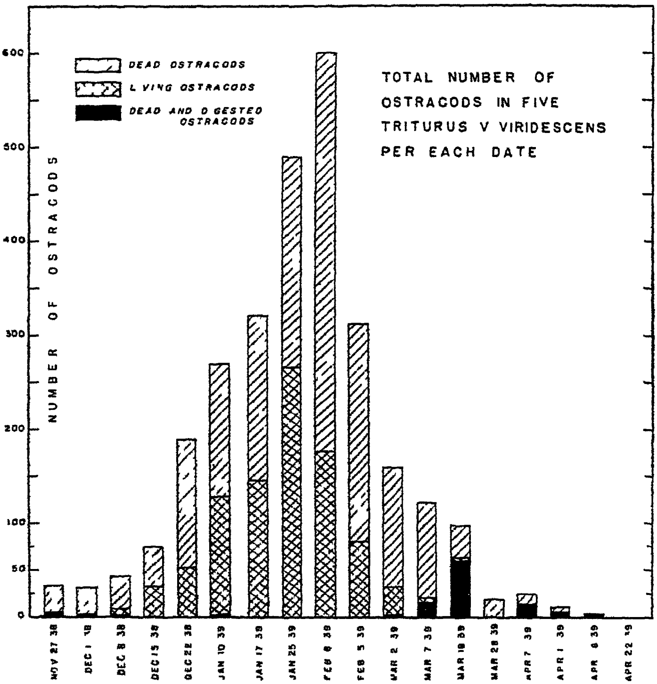

PROTO NAUCORIDÆ
PROTO-HELOTREPHIDÆ
Antennal segments 4 tarsi 3—3—3, cephalonotal suture straight, incipient asymmetry in genital segments, ovipositor complete, form becoming narrower and strongly convex, subgenæ well developed, sternal and abdominal carinæ developing
HELOTREPHIDÆ
Arising while S America and Africa were connected (Wegener) Complete asymmetry of genital segments Reduction of labrum to membrane
Reduction of antennal segments to one by fusion
Greater fusion of head and thorax by sinuation of cephalonotal suture
Reduction of antennal segments to one in brachypterous form and sinuation of lateral margins of pronotum
Reduction in tarsal segmentation to 1—1—2 Lengthening of scutellum
Reduction of antennal segments to 1, development of flattened comb-headed scales, complete fusion of head and thorax with no cephalonotal suture, lengthening and narrowing of scutellum, sinuation of lateral margins of pronotum
Formation of a continuous subgenal and lateral pronotal plate
Extension to S Asia
PROTO-PLEIDÆ
Incipient reduction of antennal segmentation and tarsi incipient narrowing of body form
Reduction of antennæ to 3 segments Reduction of tarsi in some genera
Reduction of antennae in some genera to 3 segments Narrowing and elongation of body form hemielytra becoming entirely membranous with reduction of embolium (clavulus) to a vestige, elongation of legs development of stridulatory areas on front legs Reduction in tarsal segmentation to 3—3—2
NAUCORIDÆ
(World-wide)
PARATREPHES
(French Guiana)
NEOTREPHES
(Brazil)
IDIOCORINÆ
(Lake Tanganyika)
HELOTREPHINÆ
(Africa and S Asia)
PLEIDÆ
(World-wide)
NOTONECTIDÆ
(World-wide)

The presence of live ostracods in the upper part of the *Triturus* intestinal tract in varying numbers was noted from November 27. 1938, to March 18, 1939, during which time the temperature of the water never rose above 5° C. An attempt was first made to place the living ostracods back in pond water to see whether they could be cultured at room temperature. All attempts at this type of resuscitation failed. But the *Cypria,* placed in normal amphibian ringers in the refrigerator at 2·5° C., remained alive from ten days to three weeks; while of 53 animals established in amphibian ringers, plus pond detritus, on December 15, 1938, five managed to survive until March 26, 1939. These survivors appeared to show a change in coloration, turning from orange to milky white.

As warm weather advanced and the water temperature increased, there was a corresponding decrease in the number of live *Cypria* in the intestine, the number of dead but undigested ostracods (those with entire shells) increased, as did the number of dead and partially digested *Cypria.* By April 16 the ostracods, diminished in total numbers in the gut, were all partially digested; and by April 22 the *Cypria* had apparently been given up as an article of diet by the *Triturus*, as there were none to be found in the digestive tracts of all animals examined. This situation is illustrated in the chart on p. 128.

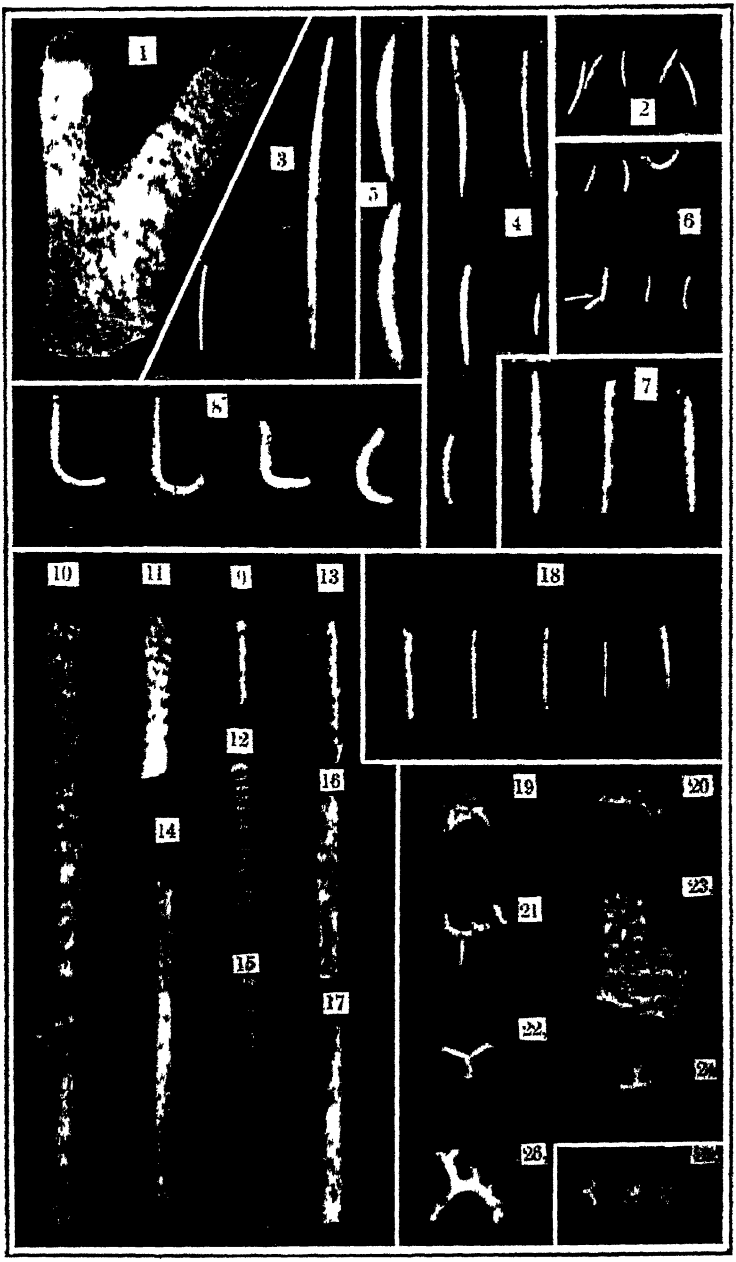
The number of *Cypria* in the intestine of a single *Triturus* during December, January, February and March varied from 0 to 129. The number of live ostracods was never greater than 80 per cent. in any individual.

The reason for the presence of live animals in the intestine of these Trituri is not too obscure. It is certain that *Cypria elegantula* is no parasite—those that were examined showed no tendency in that direction. Similarly commensalism is out of the picture, for no benefit to either *Cypria* or *Triturus* is derived from the relationship described above. Another theory that appears equally improbable is that the ostracods hibernate in the intestine of the *Triturus*, and that when spring and warmer weather obtain, they are eliminated into the water able to carry on in normal fashion. More likely is the probability that when the vernal warming of the water occurs, the *Cypria* are slowly digested in the intestien of the salamander. Thus it seems clear that the low temperature of the water during the cold months of the year, by decreasing the metabolic activity of the intestine of *Triturus*, is responsible for this curious phenomenon. It is not at all unlikely that the same condition is to be found in other vertebrates The most important question concerns itself with the adaptation of the ostracod to its new environment; and similarly *in vitro*, with its adaptation to amphibian ringers solution.

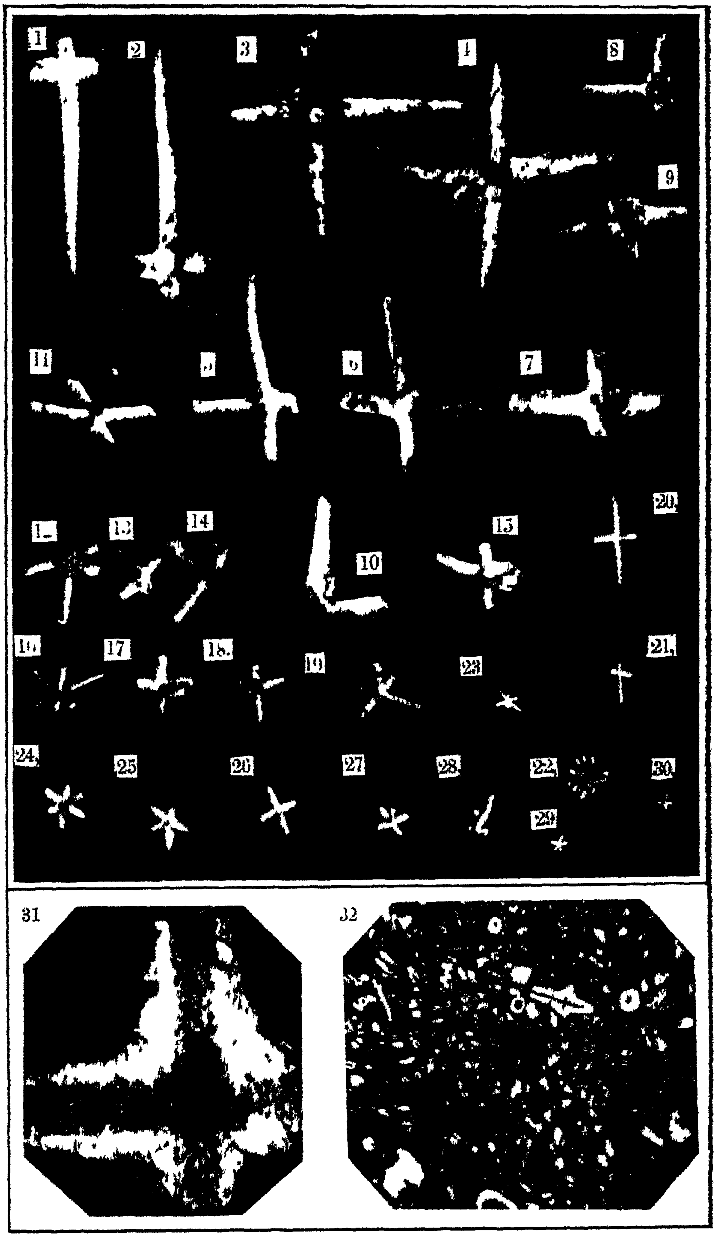


Dr. John S. Rankin Jr., of Amherst College, in private communication informed the author that he has often found beetle larvæ, various species of Cladocera and Ostracoda alive in the stomach and anterior intestine of fishes, amphibians and reptiles some time after the death of the host. He has never found this condition obtaining in warm-blooded animals. In one instance during the winter, Dr. Rankin reports finding ostracods and *Cyclops* alive in fourteen specimens of *Triturus v. viridescens* after the salamanders had been in the laboratory refrigerator a week without food.

LEWIS *Ann. & Mag. Nat. Hist. S. 11. Vol. V. Pl. I.*



MICROFOSSILS FROM THE LOWER PALÆOZOIC ROCKS OF BRITAIN.



MICROFOSSILS FROM THE LOWER PALÆOZOIC ROCKS OF BRITAIN.

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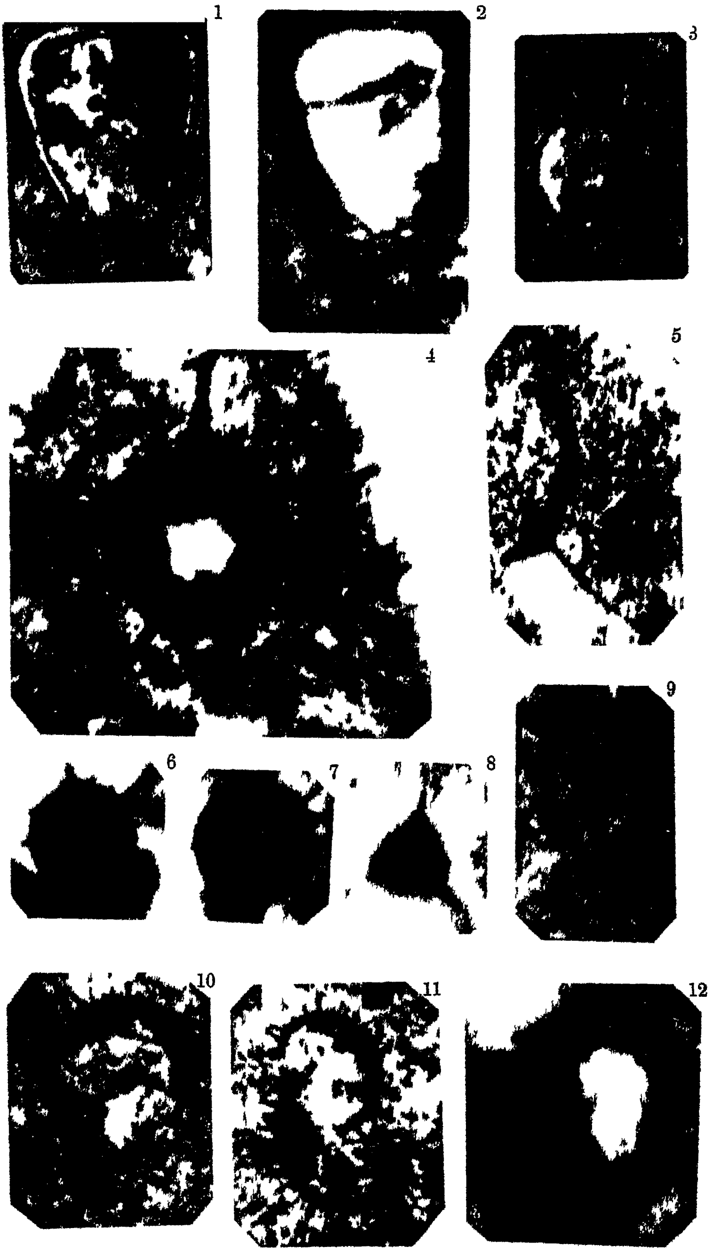
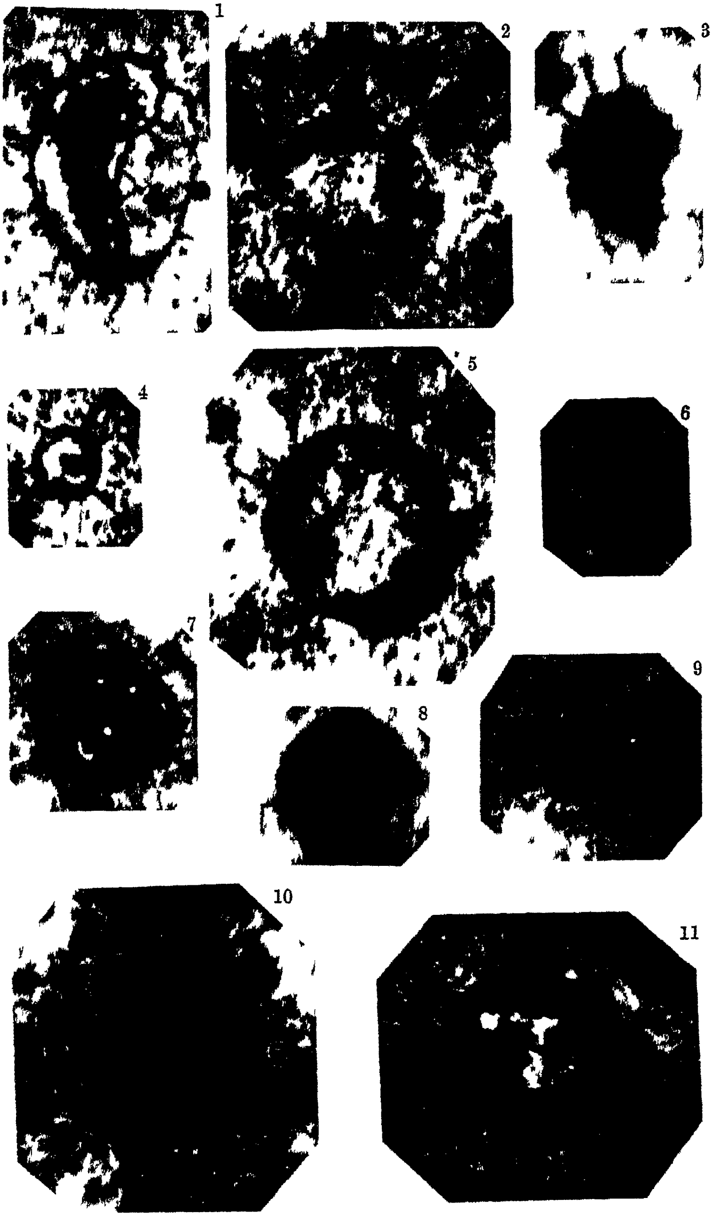


MICROFOSSILS FROM THE LOWER PALÆOZOIC ROCKS OF BRITAIN.

LEWIS Ann. & Mag Nat. Hist. S. 11. Vol. V. Pl. IV.



MICROFOSSILS FROM THE LOWER PALÆOZOIC ROCKS OF BRITAIN.

THE

ANNALS AND MAGAZINE

OF

NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 26. FEBRUARY 1940.

XI.—*A Synopsis of the Brazilian Species of* Neoelmis *Musgrave* (*Coleoptera*, Elmidæ). By H. E. Hinton, Ph.D., Department of Entomology, British Museum (Nat. Hist.).

At the time of writing only three species of *Neoelmis* have been recorded from Brazil (Hinton, 1939). To these are now added seven new forms: and one species previously known only from French Guiana is recorded here for the first time from Brazil, thus bringing the number of Brazilian species up to eleven, as follows:—

1.	*Neoelmis*	*prosternalis* Hinton	5
2.	..	*giga* Hinton	10
3.	..	*plaumanni*, sp. n.	2
4.	..	*lobata* Hinton...........	4
5.	..	*maculata*, sp. n.	30
6.	..	*mamorata*, sp. n.	1
7.	,,	*ampla*, sp. n.	1
8.	..	*limosa* (Grouvelle)	81
9.	,,	*fossa*, sp. n.	1
10.	..	*nana*, sp. n.	3
11.	..	*musgravei*, sp. n.	16
		Total number of specimens examined..	154

Neoelmis is apparently one of the very few large genera of Elmidæ where it is possible to separate the species satisfactorily without recourse to the characters of the male genitalia. However, these structures have been illustrated for four species which may later prove, with the addition of new forms, difficult to determine without such figures.

All illustrations were done with the aid of a camera lucida. Lines next to figures refer to a length of 0·20 mm. unless otherwise indicated.

Fig. 1

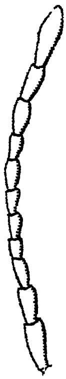
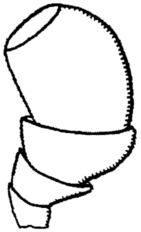


Fig. 2.



Neoelmis apicalis (Sharp).

Fig. 1.—Antenna.
Fig. 2.—Maxillary palp.

NEOELMIS Musgrave.

1935. *Neoelmis* Musgrave, Proc. Ent. Soc. Wash. (2) xxxvii. p. 34.
1936. *Neoelmis* Hinton, Ent. Mon. Mag. lxxii. p. 5.
1936. *Elmis* Darlington, 'Psyche,' xliii. p. 79.

The limits of this genus have been little understood, and the opportunity is taken here of giving a redescription which includes not only the external characters but also those to the internal anatomy.

Body usually subparallel and usually long and narrow. Non-tomentose areas glabrous or clothed with sparse and short recumbent hairs. Scale-like or hairy tomentum confined to the following areas:—(1) genæ; (2) epipleura; (3) sides of prosternum (in some species, e. g., *maculata*, there is no tomentum here), mesosternum, metasternum, and abdominal sternites, but in some species nearly the entire metasternum and the sternum of the abdomen is clothed with fine tomentum; and (4) part of all of legs except tarsi. *Head* when seen from below capable of being retracted so that none of the mouth-parts is visible. Antennæ 11-segmented (fig. 1). Mandibles with three subacute apical teeth; prostheca long and entirely membranous, with numerous long spines or hairs apically. Maxilla with the palp 4-segmented (fig. 2) and stipes with a well-developed palpifer; galea and lacina separate and apex of each densely spinose or hairy. Labium with the palp 3-segmented and prementum without a distinct palpiger. Mentum about as broad and three-fourths as long as submentum. Gula slightly longer than submentum, at anterior margin about four-fifths as broad as submentum, and with the sides feebly converging so that at posterior margin it is only half as broad as submentum. *Pronotum* with the anterior margin moderately arcuate at middle and on each side behind eye before apical angle broadly and moderately deeply sinuate. Base trisinuate, broadly and moderately deeply so on each side and more narrowly and shallowly so in front of scutellum. Pronotum on each side with a sublateral carina which usually extends from base nearly to anterior margin, though in some species it extends only to apical fourth; at apical two-fifths with a deep, broad, and complete transverse impression; disk on either side of transverse impression evenly convex, though occasionally gibbous in front of scutellum. *Elytra* punctate and striate; each elytron with a sublateral carina on sixth interval. Hind wing with a very feebly developed anal lobe; without a radial cross-vein or an anal cell; first anal usually absent; second anal with the second branch absent; third anal only present basally and not joined to second anal; fourth anal well developed; and cubito-anal cross-vein joining cubitus to second anal, though often incomplete. *Prosternum* very long in front of anterior coxæ; prosternal process long, narrow or broad, and posterior margin nearly truncate to broadly rounded. Mesosternum with a deep and broad groove for the reception of the prosternal process. Metasternum with a median longitudinal impressed line. *Legs* with the visible portion of the front coxæ rounded and trochantin completely concealed by the hypomera and sternum. Claws without teeth. *Alimentary canal* with three, two (fig. 3), or no (fig. 4) cæca on the anterior margin of the mid-gut. Hind gut with four Malpighian tubules which end freely near the rectum. *Male reproductive system* (fig. 5) with the lateral accessory glands lobed. Each testis with two sperm-tubes. Female reproductive system (fig. 6) with four egg-tubes to each ovary. Spermathecal duct opening into middle of bursa copulatrix. *Central nervous system* with three thoracic discrete ganglia; abdominal ganglia one to six discrete; and seven and eight fused, but with the limits of each distinguishable.

Fig. 3.

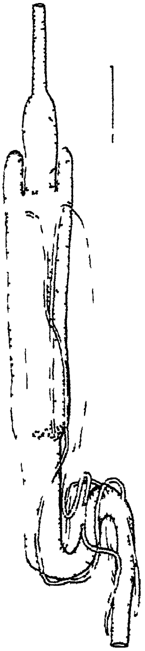


Fig. 4

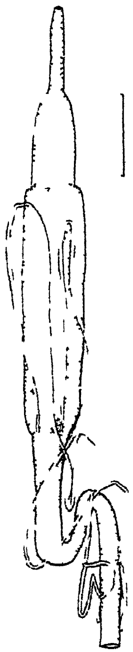


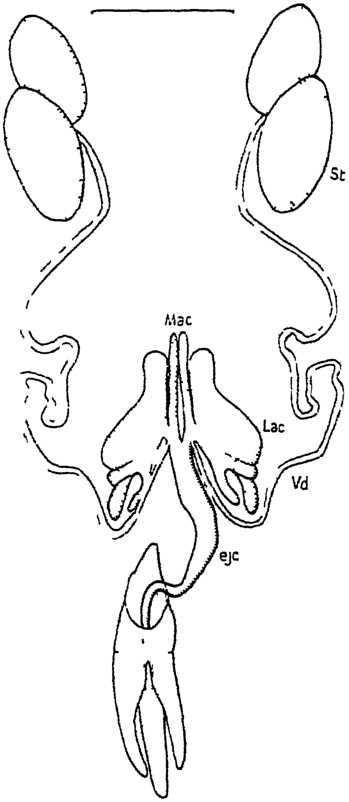
Fig. 3.—Alimentary canal of *Neoelmis limosa* (Grouv.). Seven specimens have been examined from Brazil and French Guiana, and all found to have two cæca on the anterior margin of the mid-gut.

Fig. 4.—Same of *N. maculata*, sp. n. Five specimens were examined, and all found to have no cæca on the anterior margin of the mid-gut.

Genotype.—*Neoelmis gracilis* Musgrave.

The internal anatomy of *N. thoracica* (Grouv.), *N. limosa* (Grouv.), and *N. maculata*, sp. n., has been examined and found to agree in essential details except that the number of cæca on the anterior margin of the mid-gut varies. An interspecific variation involving a feature of major anatomical importance is rather surprising, though not entirely unknown. Hinton (1939) has shown that *Stegoelmis geayi* has 14 cæca on the anterior margin of the mid-gut, while *S. verrucata* has only 11 here.

Fig. 5.



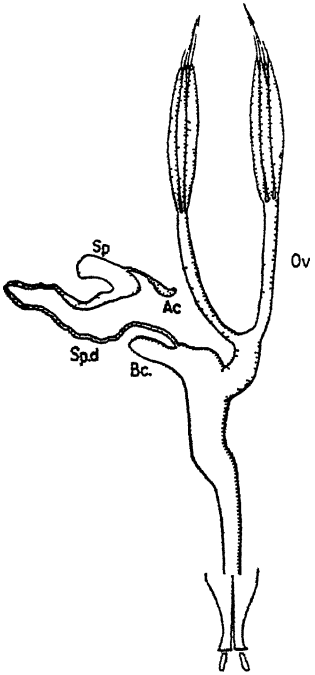
Neoelmis thoracica (Grouv.). Male reproductive system.

ejc. ejaculatory duct; *Lac.*, lateral accessory gland; *Mac.*, vesiculæ seminales; *St.*, sperm-tube; *Vd.*, vas deferens.

Generally speaking the number of cæca of the mid-gut is a character of family importance, *e. g.*, in the Orthoptera the Acrididæ always have 6 cæca and the Mantidæ always 8.

This genus appears to be nearer to *Esolus* Muls. than to any other described genus. From *Esolus* it may be distinguished as follows :—(1) the hypomera are not clothed with tomentum ; (2) the pronotum has a deep and complete transverse impression on apical two-fifths, whereas in *Esolus* it is more or less evenly convex ; (3) the hind wing has the second anal branched and at least part of a cubito-anal cross-vein is present, whereas in *Esolus* the second anal is not branched and there is

Fig. 6



Neoelmis thoracica (Grouv.). Female reproductive sytem.

Ac., accessory gland ; *Bc.*, bursa copulatrix ; *Ov.*, oviduct ; *Sp.*, spermatheca ; *Sp.d.*, spermathecal duct.

no cubito-anal cross-vein; (4) the anterior margin of the mid-gut has three, two, or no cæca, whereas in *Esolus* (only one species has been examined) no cæca are present: and (5) the central nervous system has only the seventh and eighth abdominal ganglia partly fused, whereas in *Esolus* the terminal abdominal ganglion consists of a fusion of ganglia four to eight.

A list of the specific characters which seem to be of most importance in distinguishing the species of *Neoelmis* is as follows:—

(1) General proportions, length and breadth.

(2) Colour. In some species, e. g., *mamorata*, the elytra is maculate.

(3) Size and distribution of the punctures on the various sclerites and the density and type of micro-sculpture between them.

(4) Condition of fronto-clypeal suture.

(5) Anterior margin of clypeus, whether rounded, truncate, emarginate, or sinuate; and also the condition of the angle on each side.

(6) Condition of anterior margin of labrum and angle on each side.

(7) Outline of pronotum and general proportions.

(8) Extent and prominence of sublateral carinæ.

(9) Condition of disk of pronotum, whether with gibbosities or with two halves evenly convex.

(10) Shape of elytral apices.

(11) Shape of scutellum, and if convex or flat.

(12) Condition of anterior portion of prosternum, whether straight or bent ventrally when viewed from the side.

(13) Extent of tomentum, if any, on sides of prosternum.

(14) Condition of prosternal carinæ. In some species they are absent, but when present may be parallel, diverging or converging anteriorly, or contiguous anteriorly. If parallel the distance between them should be given.

(15) Breadth and shape of prosternal process.

(16) Condition of sides of prosternal process. In some species they are strongly gibbous, while in others they are not at all thickened.

(17) Extent and depth of mesosternal groove.

(18) Disk of metasternum whether flat or not and the extent and depth of impressions.

(19) Length, shape, and prominence of carinæ, if present, on middle of first abdominal sternite.

(20) Secondary sexual characters.

(21) Structure of male genitalia. No instance is known of two or more species having genitalia alike.

A list of the secondary sexual characters that have been observed in the species before me is as follows :—

(1) Male with a tooth on anterior margin of prosternum (*giga*, *prosternalis*, *simoni*).

(2) Male with the disk of the metasternum more strongly and extensively concave than that of the female (*giga*, *lobata*, *musgravei*, *prosternalis*).

(3) Each side of median impression of metasternal disk of male with numerous testaceous hairs and also densely punctate, whereas in female this region is glabrous, or nearly so, and is also finely, sparsely punctate (*musgravei*).

(4) Male with and female without carinæ on middle of first abdominal sternite (*prosternalis*).

(5) Male with the carinæ of the first abdominal sternite converging, while in the female they are straight (*giga*).

(6) Male with a tubercle on each side of middle of first abdominal sternite (*giga*, *prosternalis*).

(7) Male with and female without anterior middle of second abdominal sternite feebly depressed (*longula*).

(8) Male with inner apex of front tibia gibbous (*giga*).

(9) Male with a row of short and stout spines on inner apex of middle tibia (*giga*, *prosternalis*).

(10) Male with a row of short and stout spines on ventral side of apical segment of middle and hind tarsi (*giga*, *lobata*, *prosternalis*).

A Key to the Brazilian Species of Neoelmis.

1. Species over 3·0 mm. long .... 2.
Species under 2·5 mm. long. .... 3.
2. Scutellum strongly convex. Males with the anterior prosternal tooth 0·07 mm. long, directed vertically downwards, and as long as broad; first abdominal sternite with only the anterior portion of the middle concave; first abdominal sternite with a discrete tubercle on each side of middle on posterior sixth; inner

apex of front tibia not gibbous; genitalia with apex of median lobe feebly spatulate. Females with carinæ of first abdominal sternite absent. (Nova Teutonia.) ... *N. prosternalis* Hinton.

Scutellum only feebly convex. Males with the anterior prosternal tooth 0·10 mm. long, directed posteriorly, and not more than half as long as broad; first abdominal sternite with entire middle concave; tubercles of first abdominal sternite united to lateral carinæ; inner apex of front tibiæ longitudinally gibbous; genitalia with apex of median lobe evenly narrowed. Females with carinæ of first abdominal sternite complete. (Nova Teutonia.) .. *N. giga* Hinton.

3. Prosternum when seen from the side nearly straight; prosternal carinæ absent. (Nova Teutonia.) .... *N. plaumanni*, sp. n.

Prosternum when seen from the side distinctly bent ventrally; prosternal carinæ present .... 4.

4. Prosternal carinæ contiguous anteriorly; prosternum at middle before anterior margin with a broad transverse gibbosity. (Nova Teutonia.) .... *N. lobata* Hinton.

Prosternal carinæ never contiguous; prosternum at middle before anterior margin without a gibbosity .... 5.

5. Prosternal process broad between coxæ; prosternal carinæ wider apart than sides of process near base .... 6.

Prosternal process narrow between coxæ; prosternal carinæ never wider apart than sides of process near base .... 9.

6. First abdominal sternite with short but distinct carinæ. (Manaos.) .... *N. maculata*, sp. n.

First abdominal sternite without carinæ. 7.

7. Pronotum with the sublateral carinæ only extending to apical fourth. Elytra maculate. (Rio Candeïa near Porto Velho.) *N. mamorata*, sp. n.

Pronotum with sublateral carinæ extending to apical twelfth. Elytra unicolorous .... 8.

8. Metasternum scarcely noticeably depressed posteriorly. (Tributary of Rio Giparana near the latter's junction with Rio Madiera.) .... *N. ampla*, sp. n.

Metasternum strongly depressed on posterior middle half. (Porto Velho, Manaos, and Belem.) .... *N. limosa* (Grouv.).

9. Disk of metasternum on each side with a large oval depression near middle coxal cavity. (Manaos.) .... *N. fossa*, sp. n.

Disk of metasternum without a depression on each side near middle coxal cavity .. 10.

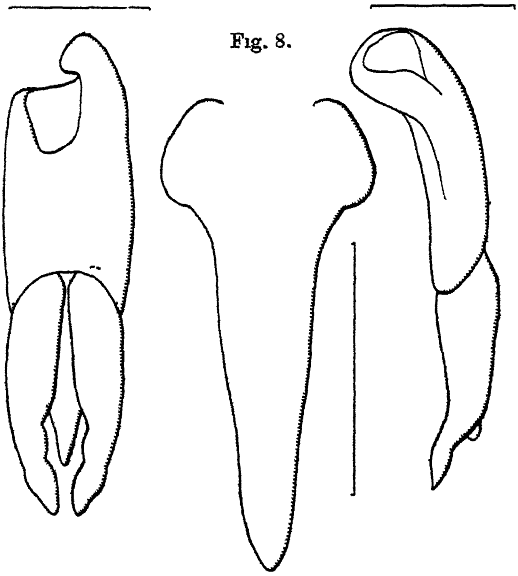
10. Prosternal carinæ strongly converging anteriorly. (Nova Teutonia.) .... *N. nana*, sp. n.

Prosternal carinæ parallel. (Nova Teutonia.) .... *N. musgravei*, sp. n.

Neoelmis plaumanni, sp. n. (Figs. 7–9.)

Male.—Length 2·21 mm.; breadth 1·04 mm. Elongate, subparallel, moderately convex. Cuticle shining, dark rufo-piceous; antennæ, mouth-parts, legs, and most of ventral surface slightly paler. *Head* without distinct impressions; surface with shallow punctures half to two-thirds as coarse as facets of eyes and usually contiguous to separated by one diameter, though on middle sparser, here being often separated by as much as three diameters; surface between punctures smooth. Clypeus with fronto-clypeal suture indistinct; anterior margin, as seen from front, feebly, arcuately emarginate for entire breadth, nearly truncate; angle on each side broadly rounded; surface punctate as sides of head, but more regularly and slightly more densely so. Labrum with anterior margin feebly rounded and angle on each

Fig. 7. Fig. 8. Fig. 9



Neoelmis plaumanni, sp. n

Fig. 7.—Dorsal view of male genitalia.
Fig. 8.—Dorsal view of median lobe dissected out.
Fig. 9.—Left lateral view of genitalia.

side broadly rounded; surface with numerous indistinct punctures as fine as those of clypeus. *Pronotum* across broadest point, which is at basal third, not quite as broad as long (0·60 mm. : 0·63 mm.) and base broader than apex (0·54 mm. : 0·41 mm.). Sides feebly arcuate, broadly and feebly sinuate before hind angles, very broadly and more feebly sinuate at apical two-fifths. Lateral margins finely and moderately regularly crenate. Sublateral carinæ prominent, sharp, and extending from base very nearly to apex. At base in front of scutellum with a broad, short, flat-topped carina on each side of which is a moderately deep, oval impression about two-fifths as broad as scutellum. Surface with round to irregular punctures finer than facets of eyes but coarser than those of head and usually separated by two to three diameters; surface on bottom of apical transverse impression finely and densely asperate. *Elytra* more than twice as long as pronotum (1·47 mm. : 0·63 mm.) and across apical third broader than across base (1·04 mm. : 0·60 mm.). Humeri feebly gibbous. Lateral margins very feebly crenate, nearly smooth. Apices moderately strongly produced and broadly conjointly rounded. Intervals flat; surface punctate like middle region of head but more sparsely so; at extreme base with a few fine, round granules. Striæ absent on apical half to two-fifths; strial punctures on disk deep, usually subquadrate, two-thirds as broad as scutellum, basal two punctures on first stria confluent, and others separated by one-half to one diameter; towards apex these punctures become much finer, so that on apical fourth they are only slightly broader than facets of eyes and are separated by three diameters. *Scutellum* feebly convex, oval, slightly broader than long; surface with fine punctures like elytral intervals, and here also with the surface between punctures smooth. *Prosternum* without tomentum; when viewed from side nearly straight; process narrow (0·11 mm. between front coxæ), apex broadly rounded, and sides feebly raised so that middle region appears longitudinally channeled: prosternum without carinæ, strongly depressed posteriorly on each side, and laterad to this depression with a short ridge as high as sterno-tergal suture; anterior margin of prosternum nearly truncate at middle: surface throughout densely asperate. Hypomera only asperate near extreme anterior and posterior margins, bottom of depressions. and occasionally near sterno-notal suture; surface elsewhere punctate like middle region of head. Mesosternum with groove for reception of prosternal process broad and deep and posteriorly occupying most of middle mesosternum. Metasternum with median longitudinal line nearly complete, posteriorly 0·08 mm. broad and two-thirds as deep as broad, and anteriorly narrowed so that on anterior fourth it is only a third as broad and relatively shallow; surface of disk on each side densely clothed with coarse, suberect, golden-testaceous hairs which are 0·027 mm. to 0·04 mm. long. *Abdomen* with entire middle of first sternite deeply, and anterior middle half of second feebly, depressed; carinæ of first sternite complete and strongly raised. Surface of first two sternites at middle finely punctate, elsewhere and on other sternites tomentose and with a few fine granules showing through tomentum. Apical sternite at middle posterior margin with a longitudinal, oval, moderately deep depression. *Genitalia* as figured (figs. 7–9).

Female.—Unknown.

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: Santa Catharina, Nova Teutonia. 1936 (*F. Plaumann*).

Paratype.—A male with same data as type.

Comparative Notes.—This species may be separated from its Brazilian congeners as shown in the key given above. From all known species it may be distinguished by the complete absence of prosternal carinæ.

Neoelmis maculata, sp. n. (Figs. 10 & 11.)

Male.—Length 1·7 mm.; breadth 0·76 mm. Elongate. feebly subparallel, moderately strongly convex. Cuticle shining; colour testaceous to rufo-testaceous, with eyes, basal half of head, and basal half of pronotum nearly black and apical four-fifths of elytra, except sides, dark brownish testaceous. *Head* without distinct impressions: surface very densely and finely asperate and near sides with an occasional oblong granule about as coarse as an eye-facet. Clypeus with fronto-clypeal suture obsolete: anterior margin, as seen from front, nearly truncate; angle on each side broadly rounded; surface with numerous punctures which are about half as coarse as facets of eyes. Labrum with anterior margin feebly rounded and angle on each side broadly rounded: surface punctate like that of clypeus. *Pronotum* across broadest point, which is at basal third, not quite as broad as long (0·52 mm. : 0·56 mm.) and base broader than apex (0·49 mm. : 0·38 mm.). Sides feebly arcuate, very broadly and scarcely noticeably sinuate opposite apical transverse impression and again before basal angles. Lateral margins finely, sparsely, and regularly crenate. Sublateral carinæ prominent, sharp, and extending brom base to anterior twelfth. On base on each side of scutellum with a deep, oval impression which is about half as coarse as scutellum. Surface with round puntures which are half to two-thirds as coarse as facets of eyes and are separated by half to three diameters: surface anteriorly between sublateral carinæ and lateral margins slightly more coarsely and very densely punctate so that it here appears asperate; surface between punctures smooth. *Elytra* twice as long as pronotum (1·15 mm. : 0·56 mm.) and across apical third much broader than across base (0·76 mm : 0·54 mm.). Humeri moderately gibbous. Lateral margins finely and regularly crenate. Apices moderately produced and conjointly rounded. Intervals flat; surface punctate, somewhat like anterior discal region of pronotum, but also occasionally feebly alutaceous. Striæ absent on apical half to three-fifths; strial punctures on disk deep, round, nearly as coarse as intervals, and separated longitudinally by one diameter: beyond basal half the strial punctures become very much finer and sparser and are here only a fourth as coarse as those on middle of disk, while on apical third strial punctures are nearly as fine as those of intervals. *Scutellum* flat, slightly longer than broad, and oval with base nearly truncate; surface punctate as adjacent elytral intervals. *Prosternum* without tomentum; when viewed from side with anterior three-fifths (not including process) moderately strongly and sharply bent ventrally; process broad (0·11 mm. between coxæ), apex nearly truncate, and sides feebly raised so that middle appears longitudinally channeled; carinæ prominent, present on basal half, very feebly diverging forwards, and posteriorly enclosing an area broader than base of process; anterior margin very feebly rounded; surface punctate like pronotum but anterior sides asperate. Hypomera punctate like prosternum but with extreme anterior sides asperate. Mesosternum with groove for reception of prosternal process narrow on anterior two-fifths but posteriorly occupying all of mesosternum. Metasternum with median longitudinal line complete, posterior three-fifths 0·05 mm. broad and anterior two-fifths a fourth as broad; dsik feebly depressed on posterior middle three-fifths and on each side at base with an oval depression which is about as broad as basal part of median longitudinal line; surface of disk entirely tomentose. *Abdomen* with anterior middle three-fifths of first sternite deeply depressed, anterior sides strongly raised, and carinæ prominent and extending about a third of distance across sternite. Anterior middle two-fifths of first sternite finely and sparsely punctate but abdomen elsewhere entirely tomentose. Apical margin of fifth

Fig. 10.

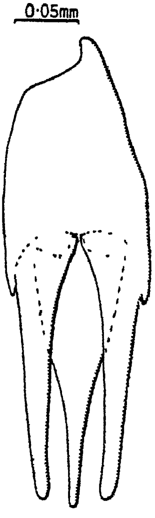
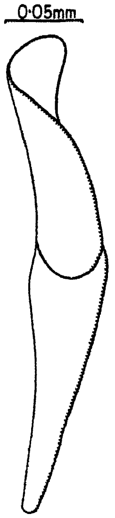


Fig. 11.



Neoelmis maculata, sp. n.
Fig. 10.—Dorsal view of male genitalia.
Fig. 11.—Left lateral view of same.

sternite with a slight tuft of hairs on each side of middle. *Genitalia* as figured (figs. 10 & 11).

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: State of Amazonas, Manaos, alt. about 250 ft., ix. 1937 (*H. E. Hinton*).

Paratypes.—Twenty-nine, with same data as type.

Variations.—The colour of pronotum and elytra varies considerably, the constant features being that the basal half of the pronotum is always darker than apical half and basal fifth of elytra always distinctly paler than apical four-fifths. In a number of specimens the sides of elytra are pale, and on apical third there is a large oval area on each side which is as pale as basal fifth.

Comparative Notes.—This is most closely related to *N. limosa* (Grouv.), but the latter may be distinguished by its uniformly rufo-piceous instead of maculate dorsal surface, its slightly broader prosternal process, the absence of a large oval depression on each side of middle posterior margin of metasternal disk, the absence of carinæ on the first abdominal sternite, and the presence of two cæca on the anterior margin of the mid-gut.

Neoelmis mamorata, sp. n.

Female.—Length 1·80 mm.; breadth 0·73 mm. Elongate, feebly subparallel. Cuticle shining; colour pale rufo-piceous to brownish testaceous; eyes and basal part of head black; elytra with a large, pale, oval area on each side at base and with a similar but slightly smaller pale area on each side at apical third near sublateral carina. Externally similar to *N. maculata* except as follows:—(1) the pronotum is proportionally narrower (length greater than breadth across broadest point, which is at basal third, 0·54 mm.: 0·46 mm.; and base broader than apex, 0·43 mm.: 0·35 mm.); (2) the sublateral carinæ of the pronotum are feebly raised instead of prominent and only extend to apical fourth instead of to apical twelfth; (3) the discal strial punctures of the elytra are nowhere more than a third as broad as intervals, whereas in *maculata* they are frequently as coarse as intervals; (4) the posterior portion of the median longitudinal line of the metasternum is much narrower (0·02 mm.: 0·05 mm.); (5) there is no large and deep oval impression on each side of middle posterior margin of metasternum; and (6) the first abdominal sternite is without carinæ.

Male.—Unknown.

Type.—A female in the collection of the British Museum (Nat. Hist.). Brazil: State of Matto Grosso, Rio Candeïa, 30. viii. 1937 (*H. E. Hinton*).

Comparative Notes.—This may be distinguished from all other described species by the very feebly raised sublateral carinæ of the pronotum and their absence on apical fourth.

Neoelmis ampla, sp. n.

Female.—Length 1·67 mm.; breadth 0·63 mm. Elongate, feebly subparallel. Cuticle shining; colour black to dark rufo-piceous; antennæ, mouth-parts, and legs paler. Externally similar to *N. limosa* (Grouv.) except as follows:—(1) discal elytral punctures of sutural stria only a third to a fourth as broad as sutural interval, whereas in *limosa* these punctures are a half to as broad as sutural interval; (2) prosternal process between front coxæ narrower (0·11 mm.: 0·16 mm.); (3) median longitudinal line of metasternum on posterior half narrower (0·027 mm.: 0·054 mm.), much shallower, and with the sides nearly vertical instead of gradually sloping inwards; and (4) first abdominal sternite only feebly depressed on anterior fifth, whereas in *limosa* this sternite has the anterior half depressed, the anterior third being deeply so.

Male.—Unknown.

Type.—A female in the collection of the British Museum (Nat. Hist.). Brazil: State of Matto Grosso, tributary of the Giparana, 4. ix. 1937 (*H. E. Hinton*).

Neoelmis limosa (Grouv.). (Fig. 3.)

1908. *Elmis limosa* Grouvelle, Bull. Mus. Hist. Nat. Paris, iv. p. 184.

More than 100 specimens of this species are before me from French Guiana: St. Laurent du Maroni, x. 1937 (*H. E. Hinton*). Here it is recorded for the first time from Brazil, where it has been taken in the following localities:—6, Matto Grosso, Porto Velho, 1. ix. 1937 (*H. E. Hinton*); 68, Amazonas, Manaos, ix. 1937 (*H. E. Hinton*); and 7, Pará, 55 km. from Belem on Estrada de Ferro de Bragança, 21–23. ix. 1937 (*H. E. Hinton*).

Neoelmis fossa, sp. n.

Male.—Length 1·72 mm.; breadth 0·73 mm. Elongate, moderately subparallel, strongly convex. Cuticle shining and moderately dark rufo-piceous; antennæ, mouth-parts, and legs paler, nearly rufo-testaceous. *Head* without distinct impressions; surface everywhere densely asperate except anteriorly at middle where it is sparsely asperate and feebly, transversely alutaceous. Clypeus with the fronto-clypeal suture indistinct; anterior margin feebly and arcuately emarginate for its entire breadth, and angle on each side very broadly rounded; surface with fine punctures which are a half to two-thirds as coarse as facets of eyes and at sides are frequently confluent but on middle are usually separated by one to two diameters. Labrum with anterior margin feebly rounded. nearly truncate; anterior angles broadly rounded; surface punctate like middle of clypeus but slightly more finely and sparsely so. *Pronotum* across broadest point, which is near basal third, as broad as long (0·57 mm. : 0·57 mm.) and base broader than apex (0·54 mm. : 0·38 mm.). Sides feebly arcuate and shallowly but distinctly sinuate before hind angles. Lateral margins with short but distinct and regular crenations. Anterior angles strongly and very acutely produced so that they are spinose. Sublateral carinæ prominent, sharp, and extending to anterior twelfth. Near base on each side of scutellum with an oval moderately deep impression which is about a third as broad as scutellum. Surface with round punctures which are about three-fourths as coarse as facets of eyes and are usually separated by two to five diameters; surface between punctures smooth and polished; anterior tenth between sublateral carinæ and lateral margins asperate like surface of head. *Elytra* twice as long as pronotum (1·12 mm. : 0·57 mm.) and across broadest point, which is at apical third, broader than at base (0·73 mm. : 0·57 mm.). Humeri moderately gibbous. Lateral margins nearly smooth. Apices moderately produced and conjointly broadly rounded. Intervals flat; surface punctate somewhat like pronotal disk. Striæ absent on apical half; strial punctures on disk round to irregular, deep, two-thirds as broad to one-third broader than intervals; at apical half these punctures suddenly become as fine as those of surface of intervals and are separated by five to ten diameters. *Scutellum* flat, subovate, slightly longer than broad, and base feebly rounded; surface punctate like adjacent elytral intervals. *Prosternum* with posterior three-fifths at sides tomentose; when viewed from side with the anterior three-fifths (not including process) strongly but not sharply bent ventrally; process narrow (0·08 mm. between front coxæ), apex broadly and feebly rounded, and sides broadly and moderately strongly raised so that middle appears longitudinally channeled; sides of process opposite front coxæ more strongly gibbous than elsewhere; prosternal carinæ prominent, present on basal third, and with distance between them two-thirds as great as greatest breadth of process between coxæ; on each side between prosternal carinæ and sternotergal suture with a ridge on basal third which is nearer to suture than to carinæ and is not as strongly elevated as suture; anterior margin broadly and feebly rounded; surface punctate somewhat like elytral intervals, but more densely and irregularly so. Hypomera with surface punctate like prosternum. Mesosternum with groove for reception of prosternal process narrow on anterior third, posteriorly occupying all of mesosternum, and at middle very deep. Metasternum with median longitudinal line complete, 0·055 mm. broad on posterior two-thirds though at extreme base one-half again as broad as this; median line on anterior two-fifths only a third as broad; disk on each side near middle coxal cavity with a broad and deep oval impression; disk punctate like pronotal disk, but with punctures on bottom of impressions very fine and dense. *Abdomen* with entire middle of first sternite depressed, the anterior half being very deeply so; carinæ of first sternite prominent and extending to posterior two-thirds of segment. Surface of middle region of first two sternites punctate like pronotal disk; sternites elsewhere densely tomentose.

Female.—Unknown.

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: Amazonas, Manaos, 11. ix. 1937 (*H. E. Hinton*).

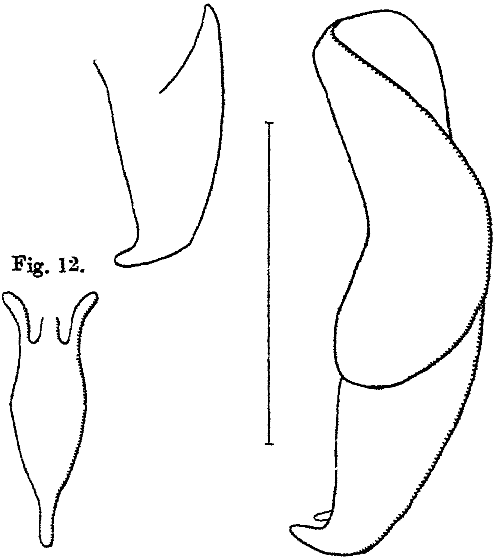
Comparative Notes.—From all other known members of the genus it may be distinguished by its very strongly and acutely produced anterior angles of the pronotum and the deep oval impression on each side of metasternal disk near middle coxal cavity.

Neoelmis nana, sp. n. (Figs. 12–14.)

Male.—Length 1·72 mm.; breadth 0·69 mm. Elongate, subparallel, moderately convex. Cuticle shining and rufo-piceous; antennæ and mouth-parts paler and somewhat testaceous. *Head* without distinct impressions; surface densely and very finely asperate and also with a few very fine (about half as coarse as facets of eyes), low, oblong granules. Clypeus with fronto-clypeal suture feebly impressed and straight; anterior margin, as seen from front, very feebly rounded, nearly straight for entire breadth; anterior angles broadly rounded; surface

Fig. 13. Fig. 14.

Fig. 12.



Neoelmis nana, sp. n.

Fig. 12.—Dorsal view of median lobe of male dissected out.
Fig. 13.—Lateral view of paramere.
Fig. 14.—Lateral left view of male genitalia.

sculptured like head, but with fine punctures not so dense that they appear asperate. Labrum with anterior margin feebly rounded and angle on each side broadly rounded; surface with fine punctures which are usually separated by one diameter. *Pronotum* across broadest point, which is at basal third, nearly as broad as long (0·55 mm. : 0·56 mm.) and base broader than apex (0·49 mm. : 0·35 mm.). Sides moderately feebly arcuate, very feebly and broadly sinuate opposite apical transverse impression, and slightly more strongly and shallowly so before hind angles. Lateral margins not distinctly crenate (magnification × 75). Sublateral carinæ prominent, sharp, and extending from base to about apical twelfth. Near base on each side of scutellum with a moderately deep, oval, round impression which is two-thirds as broad as scutellum. Surface with round to irregular punctures which are about two-thirds as coarse as facets of eyes and are usually separated by three to four diameters; surface between these punctures smooth and polished; extreme bottom of transverse impression with the punctures finer and often separated by less than one diameter; anterior tenth between sublateral carinæ and lateral margins with punctures very dense, nearly asperate. Middle of disk before transverse impression with a feeble but broad longitudinal impression which is about a fifth as long as pronotum. *Elytra* twice as long as pronotum (1·12 mm. : 0·56 mm.) and across broadest point, which is at apical third, broader than at base (0·69 mm. : 0·57 mm.). Humeri feebly gibbous. Lateral margins nearly smooth. Apices moderately produced and conjointly rounded. Intervals flat; surface more finely, indistinctly, and irregularly punctate than that of head; at base and basal sides with numerous round granules as coarse as facets of eyes. Striæ indistinct or absent on apical three-fiths; strial punctures on disk deep, round to irregular, and a third broader than intervals; on apical half these punctures become suddenly much finer, and by apical third they are no coarser than those of pronotal disk. *Scutellum* flat, subovate, longer than broad, and surface with a few fine punctures. *Prosternum* without tomentum; when seen from side with anterior three-fifths (not including process) gradually and moderately bent ventrally; process narrow (0·109 mm.

between front coxæ), apex broadly rounded, and sides thickly raised so that middle appears longitudinally channeled; carinæ feeble, present on basal two-fifths, posteriorly as wide apart as sides of process between front coxæ, but converging anteriorly so that distally they are only three-fifths as wide apart; laterally with a ridge on basal two-fifths which is nearer to tergum than to carinæ and is as prominent as sterno-tergal ridge; anterior margin feebly rounded at middle; surface finely and moderately sparsely punctate, but at sides asperate. Hypomera sculptured like pronotum between sublateral carinæ and lateral margins. Mesosternum with groove for reception of prosternal process broad and deep and all of posterior portion of mesosternal disk depressed. Metasternum with median longitudinal line attaining anterior fourth, on posterior two-fifths of disk 0·054 mm. broad, and at least two-thirds as deep as broad; disk on each side of middle at posterior margin with a broad, moderately deep, oval impression; surface of disk punctate like middle region of prosternum. *Abdomen* with anterior half of middle of first sternite moderately depressed; carinæ of first sternite broad and prominent but only present on basal fourth. Middle of first two sternites non-tomentose and generally punctate like pronotal disk, but towards sides and posteriorly also densely and very finely alutaceous; sternites elsewhere tomentose. *Genitalia* as figured (figs. 12–14).

Female.—Unknown.

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: Santa Catharina, Nova Teutonia, iii. 1936 (*F. Plaumann*).

Paratypes.—Two males with same data as type.

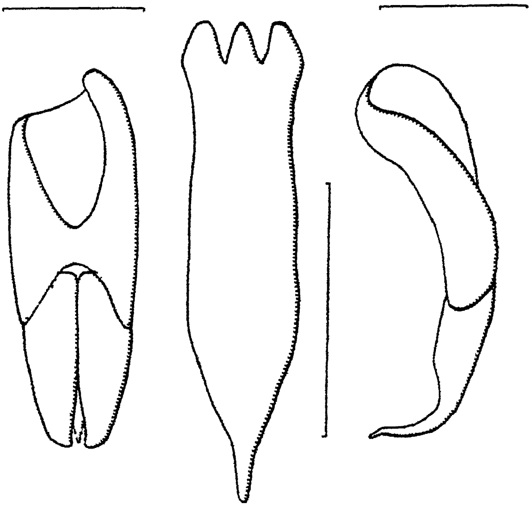
Variations.—One of the patatypes has the whole of the middle region of the head only sparsely and very finely punctate. Both paratypes have an obsolete frontoclypeal suture.

Comparative Notes.—This species is closely related to no other described, but superficially resembles *N. fossa* Hinton. From the latter it may be distinguished by not having the anterior angles of the pronotum spiniform, by the converging instead of parallel prosternal carinæ, and by not having a large oval depression on each side of metasternal disk near middle coxal cavity.

Neoelmis musgravei, sp. n. (Figs. 15–17.)

Male.—Length 1·91 mm.; breadth 0·73 mm. Elongate, subparallel, moderately convex. Cuticle shining and dark rufo-piceous; antennæ, mouth-parts, and legs paler rufo-piceous. *Head* without distinct impressions; surface very finely and densely asperate. Clypeus with fronto-clypeal suture distinct and straight; anterior margin, as seen from front, scarcely noticeably arcuately emarginate for its entire breadth, and angle on each side broadly rounded; surface with punctures nearly asperate like those of head. Labrum with anterior margin feebly and broadly rounded; angle on each side broadly rounded; surface on middle anterior half with punctures which are about two-thirds as coarse as facets of eyes and are confluent to separated by nearly one diameter; surface elsewhere with punctures much finer and slightly sparser. *Pronotum* across broadest point, which is at basal third or two-fifths, nearly as broad as long (0·58 mm. : 0·60 mm.) and base broader than apex (0·56 mm. : 0·43 mm.). Sides feebly arcuate, scarcely noticeably sinuate opposite transverse impression, and moderately broadly and shallowly sinuate before hind angles. Lateral margins finely and moderately regularly crenate. Sublateral carinæ prominent, sharp, and extending from base very nearly to apex. Near base on each side with a moderately deep oval impression which is about two-thirds as broad as scutellum; area between these two impressions feebly raised and flat-topped. Disk feebly and broadly depressed on middle behind apical transverse impression. Surface with punctures which are about two-thirds as coarse as facets of eyes and are usually separated by two to four diameters; surface on bottom of transverse impression with punctures much denser; and surface between sublateral carinæ and lateral margins with punctures also much denser but on anterior tenth asperate. *Elytra* slightly more than twice as long as pronotum (1·34 mm. : 0·60 mm.) and broadest point, which is across apical third, broader than at base (0·73 mm. : 0·57 mm.). Humeri feebly gibbous. Lateral margins smooth. Apices broadly, conjointly rounded and moderately strongly produced. Intervals flat; surface punctate like pronotal disk, but more irregularly and slightly more finely so, and also occasionally feebly alutaceous between punctures; near base and on basal sides with an occasional fine, round granule. Striæ absent on apical half; strial punctures on disk deep, round to subquadrate, and usually as coarse to slightly coarser than intervals; at about apical two-fifths these punctures suddenly become very much finer and sparser, and by apical third they are only slightly coarser than those of pronotal disk and are separated by four to five diameters. *Scutellum* flat, nearly round, with base feebly rounded, and surface with numerous fine punctures. *Prosternum* without tomentum; when seen from side with anterior half to three-fifths (not including process) gradually and moderately feebly bent ventrally; process subparallel, narrow (0·109 mm. broad between front coxæ), apex broadly rounded and sides feebly and broadly raised so that middle appears longitudinally channeled; carinæ present on basal two-fifths,

Figs. 15. Fig. 16. Fig. 17.



Neoelmis musgravei, sp. n.

Fig. 15.—Dorsal view of male genitalia.
Fig. 16.—Dorsal view of median lobe dissected out.
Fig. 17.—Left lateral view of male genitalia.

parallel, feebly raised, and distance between them not quite as great as that of sides of process between coxæ; sides on basal two-fifths with a ridge parallel to sternotergal suture and nearer to this than to carinæ, this ridge being slightly more prominent than either; anterior margin nearly truncate; surface very densely and finely punctate at middle to asperate at sides. Hypomera asperate on posterior fifth, anterior fifth, and bottom of apical impression; middle punctate like pronotal disk, but more finely and sparsely so. Mesosternum with groove for reception of prosternal process broad and deep on anterior two-fifths and posteriorly with depression occupying all of middle area. Metasternum with median longitudinal line complete, on posterior three-fifths very deep and as much as 0·109 mm. broad; surface of disk on each side of impression with dense punctures only slightly finer than facets of eyes, and here also with numerous short, moderately coarse, golden-testaceous hairs which are recumbent to suberect. *Abdomen* with entire middle of first sternite deeply depressed. Carinæ of first sternite prominent but confined to basal half of segment. Surface of middle of first two segments non-tomentose and punctate like pronotal disk, but posterior region of both segments also very finely asperate; surface elsewhere and that of other segments tomentose. *Genitalia* as figured (figs. 15–17).

Female.—Externally similar to male, but without the coarse hairs and coarse and dense punctures on the sides of the metasternal disk.

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: Santa Catharina, Nova Teutonia, iii. 1936 (*F. Plaumann*).

Paratypes.—Seven males and eight females with same data as type.

Comparative Notes.—This appears to be most closely related to *N. nana* Hinton, but may be distinguished from the latter by the parallel instead of converging prosternal carinæ and by the differently formed male genitalia (*vide* figs.).

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MUSGRAVE, P. N. 1935. “Two new Elmidæ from Puerto Rico, with Description of new Genus (Coleoptera).” Proc. Ent. Soc. Washington, xxxvii. pp. 32–35, 1 fig.

XII.—*The Ordovician Trilobite Fauna of the Shelve-Corndon District, West Shropshire.*—Part I. Agnostidæ, Raphiophoridæ, Cheiruridæ. By W. F. WHITTARD, D.Sc., Ph.D.

[Plates V. & VI.]

THE large fossil collections now available from the Ordovician outcrop of the Shelve country, Shropshire, probably include representatives of nearly all the species that are likely to be recovered from these rocks, and thus it is unnecessary to await completion of the mapping before a start is made on the description of the faunas. The trilobites will be the first to receive attention, and will be described in a series of papers ; those species of which sufficiently well preserved material is not at present available will form the subject of a concluding paper, by which time new specimens will perhaps be found.

Apart from the collections of Professor V. C. Illing and myself, the figured specimens of which will be offered to the Geological Survey Museum, I have been privileged to have access to the collections in the British Museum (Natural History), the Sedgwick Museum, and the Geology Museum of the University of Birmingham, and to the extremely valuable material in the Geological Survey Museum which was collected, under the direction of Charles Lapworth, by John Rhodes (1892–1893) and William Manson (1914).

Although Murchison, Ramsay, Aveline, Salter, and Morton devoted much time to the study of the geology of the Shelve area, the modern stratigraphical succession, which is given below, is due to Charles Lapworth, who worked in collaboration with Professor W. W. Watts. Subsequent determinations have but little altered their results, the only important differences being found in the zonal correlation of certain horizons. The rocks are extremely rich in organic remains, many of which are excellently preserved, and some faunas are of considerable interest, for they yield species which are identical with forms found abroad, particularly in Bohemia. There is considerable lithological variation throughout the succession, but nearly all horizons are prolific of fossils, even including some of the sedimentary rocks largely of volcanic origin; with few exceptions there is a noticeable lack of calcareous rocks. The correlations of the subdivisions with the graptolite zones are given in the following succession so far as they have at present been determined; future collecting promises to make these correlations more complete.

In the Shelve-Corndon area neither Ashgillian sediments nor the topmost beds of the Caradoc Series appear at the surface.

Upper Valentian, Wenlockian, or Coal Measures.

	UNCONFORMITY.	
Whittery Shales.		Caradoc Series.
Whittery Volcanic Group.		
Hagley Shales.	Base of *P. linearis* Zone or top of *D. clingani* Zone.	
Hagley Volcanic Group.		
Aldress Shales.	*D. clingani* Zone.	
Spy Wood Grit.		
Rorrington Beds.	*N. gracilis*, *D. multidens*, and *C. peltifer* Zones *.	Llandeilo Series.
Meadowtown Beds.	*G. teretiusculus* Zone.	
Betton Beds.	*D. murchisoni* Zone.	
Weston Beds †.	*D. bifidus* Zone.	Llanvirn Series.
Stapeley Shales.		
Stapeley Volcanic Group.		
Hope Shales.		
Mytton Flags.	*D. hirundo* and *D. extensus* Zones.	Arenig Series.
Stiperstones Quartzite.		
	UNCONFORMITY.	
Habberley Shales.		Tremadoc Series.

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* The Pontesford Shales, referred to the *D. multidens* and *C. peltifer* Zones, are correlated by Dr. Elles with the upper part (*Leptograptus* Beds) of the Rorrington Flags. 'Shrewsbury District,' by Pocock, R. W., Whitehead, T. H., Wedd, C. B., and Robertson, T., 1938, p. 92, Memoir Geol. Survey, Explanation Sheet 152.

† The Weston Beds were thought to appertain to the base of the *D. murchisoni* Zone (Whittard, 1931, p. 331), but recently several specimens of *D. bifidus* (for the identification of which I am indebted to Dr. Elles) have been obtained at Lyde.

Family **Agnostidæ** (s. l.) McCoy.

AGNOSTUS Brongniart. 1822.

Agnostus morei Salter.

1864 *b*. *Agnostus morea* [sic] * Salter, p. 7, pl. i. fig. 13.
1866 *a*. *Agnostus morea* [sic] Salter, p. 256.
1866 *b*. *Agnostus morei* Salter, p. 487, figs. *a* & *b*.
1869. *Agnostus morea* [sic], Morton, p. 15.
1872. *Agnostus perrugatus* Barrande, p. 143, pl. xiv. figs. 14–16.
1873. *Agnostus morei* Salter, p. 22.
1880. *Agnostus perrugatus* ?, Nicholson & Etheridge, p. 296, pl. xx. figs. 6 & 7.
1881. *Agnostus morei* Salter, p. 377.
1886. *Agnostus morei* Postlethwaite & Goodchild, p. 458, pl. vi. figs. 7 & 8.
1903. *Agnostus perrugatus* Reed, p. 6, pl. i. figs. 5–7.
1909. *Agnostus perrugatus* Holub, p. 3.

The cephalon of the holotype, which is slightly distorted laterally, is only gently convex, subquadrate, 3·8 mm. long and 3·0 mm. broad (Pl. V. fig. 1, GSM: 8699 †). The axial furrow clearly delimits the glabella, which rises slightly above the general surface of the headshield and is two-thirds the cranidial length; it is rounded anteriorly, and not pointed as illustrated by Salter, is broadest across the basal lobes, and has the least width at the level of the posterior transverse furrow. Two transverse furrows cross the glabella at one-quarter and one-half the length measured from the anterior extremity, and each carries an indistinct tubercle in the mid-line. Basal glabellar lobes are relatively large and triangular in outline. The brim is incompletely preserved, but is present along the anterior margin, where it is narrow. The cheeks are moderately constant in breadth, except posteriorly, where they are invaded by the basal lobes; approximately the anterior half of the surface of the cheek is marked by a few radiating grooves which traverse the whole breadth, and they alternate with short marginal furrows.

One incomplete pygidium of quadrangular shape has recently been collected from the Hope Shales (Pl. V. fig. 2, GSM: 69914 & 69915). The axis is about one-half the pygidial length, rounded posteriorly, and divided into

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* This is obviously a misprint for *morei*, the species having been named after Jasper More of Linley Hall.

† The abbreviations GSM, BM, and SM before registration numbers refer to the collections in the Geological Survey Museum, the British Museum (Natural History), and the Sedgwick Museum, Cambridge.

three segments of which the posterior one is the largest: the two anterior segments are interrupted by a median longitudinal ridge which is outlined by grooves. Pleural lobe carries a pronounced transverse furrow immediately behind the anterior margin; the lobes also carry faintly impressed radiating furrows, which, in better preserved specimens from the Lake District and from Haverfordwest, are much more distinct (see below). The convex border is relatively broad along the lateral margins, narrows along the posterior margin, and is produced at the postero-lateral corners into an ill-defined and short spine.

Geological Horizon and Localities.—The species is exceedingly rare, and is represented by one cephalon from Cefn Gwynlle, near Linley; Salter gave the horizon as "Lower Llandeilo (Arenig Group)." Tuffs alternating with shales referable to the Stapeley Volcanic Group constitute most of Cefn Gwynlle Hill, but in the depression on its eastern flank Hope Shales are found. Salter probably obtained the specimen from one of the trial shafts or adits driven through the Hope Shales. The solitary pygidium was collected from the Hope Shales exposed in Josey's Wood Brook, 400 feet south-east of its confluence with the Hope Dingle Stream, Wagbeach, near Minsterley.

Holotype.—GSM: 8699.

Remarks.—The cephalon described above is the holotype, but two years after Salter had founded the species he was able to describe further material (including pygidia) from the Skiddaw Slates of Ellergill. Millburn. Additional specimens have been figured by Postlethwaite and Goodchild (1886, p. 458, pl. vi. fig. 8), and it is clear from casts of the originals (GSM: 8697 & 8698) that the cephalon has a well-defined brim and that the radiating grooves on the fixed cheek occur as far back as the level of the basal lobes; these details supplement the description of the holotype, which is less completely preserved. Undescribed specimens have also been recovered from the Llanvirn beds of Long Plantation cutting, Haverfordwest (SM: A 15597–15600); two individuals show the cephalon and the pygidium disarticulated, and on one there is a thoracic segment which has been inverted during entombment (Pl. V. fig. 3, SM: A 15599). The axis of the thoracic segment is slightly more than half the total breadth and carries on each side a large, ellipsoidal, lateral lobe the major axis of which is disposed horizontally ; the pleuræ extend outwards for a short distance and are then deflected posteriorly.

Barrande (1872, p. 143, pl. xiv. figs. 14–16) considered that *A. perrugatus* might be identical with *A. morei*, for after stating that Salter's figures do not show the basal lobes or the glabellar furrows he goes on to write that " nous pensons que ces différences apparentes pourraient s'évanouir, si on connaissait de meilleurs spécimens de la forme anglaise." The re-examination of the holotype of *A. morei* and other material has proved that basal lobes and two glabellar furrows are present and that there is no difference between the cephalon of this species and that of *A. perrugatus*. Furthermore, the pygidia of *A. morei* from the Hope Shales, the Skiddaw Slates, and the better preserved material from Haverfordwest are again identical with *A. perrugatus*. Consequently, the latter is claimed as a synonym of *A. morei*. Another species is thus added to the list of trilobites common to the $D_{1\gamma}$ beds of Bohemia and the Bifidus Beds of South Wales and West Shropshire (Stubblefield, 1939, p. 54). The material from Girvan described by Reed and identified as *A. perrugatus* should also now be placed in *A. morei*.

Professor Howell, who is preparing with Dr. Resser a memoir on the Agnostia, informs me that, so far as he knows, no generic name for Agnostia of the type of *A. morei* has been proposed, and that in the forthcoming memoir *Cenagnostus* will be used to include *A. morei*, *A. perrugatus*, *A. fortis* Novák, and *A. friči* Holub.

Family **Raphiophoridæ** Angelin.

AMPYX Dalman, 1826.

Ampyx mammillatus Sars var. *austini* (Portlock).

1843. *Ampyx austinii* Portlock, p. 261, pl. i. B. figs. 1 & 2.
1846. *Ampyx nasutus* McCoy, p. 56.
1866 *a*. *Ampyx mammillatus* Salter, pp. 258 & 259.
?1873. *Ampyx salteri* Hicks MSS., Salter, p. 22.
?1875. *Ampyx salteri* Hicks, p. 182, pl. x. figs. 7 & 8.
1881. *Ampyx mammillatus* Salter, p. 390.
1884. *Ampyx salteri* La Touche, p. 56, pl. ii. fig. 34.
? 1925. *Ampyx salteri* Raymond, p. 31.

Portlock described *Ampyx austini* from rocks identified as of Llandeilo age cropping out in Co. Waterford, Ireland

(1843, p. 261, pl. i. B, figs. 1 & 2). The only specimens that I have been able to examine are from the Austin Collection in the Free Public Museum, Liverpool, and the James Collection in the Geological Survey Museum. One of Portlock's types from Newton Head, Waterford, has been found in the Liverpool Museum (1843, pl. i. B, fig. 2), and is figured in the present paper (Pl. V. fig. 4); the other type (pl. i. B, fig. 1) is not known with certainty, but it may be represented by another specimen in the Liverpool Museum or by one in the James Collection (GSM: 35324). A large number of well-preserved individuals of the variety have been recovered from Shropshire from beds referable to the Bifidus Zone, and the following description is founded upon this material.

Excluding the anterior cephalic spine the test is slightly longer than the breadth attained across the cephalon, the proportions being approximately 5 : 6 (Pl. V. figs. 5 & 6, BM : In 37306)*; the surface is almost flat, excepting the axial region, which is gently convex and reaches its maximum elevation towards the front of the glabella.

The cephalon is twice as broad as long if the anterior spine be disregarded. The glabella projects slightly beyond the general curvature of the anterior border of the cephalon and is prolonged into a hollow spine, triangular in cross-section at its base, and may be approximately the same length as the glabella or at least twice as long. The elongated glabella is defined by marked and anteriorly divergent axial furrows, which are, however, shallow where they delimit the basal glabellar segment. The small basal glabellar segment is of sturdy proportions, but the basal glabellar furrow is shallow medially and becomes deeper laterally. From the antero-lateral corners of the segment there arises a pair of outwardly and anteriorly directed curved grooves, and these separate an oval lobe which has the major axis orientated obliquely outwards; the grooves are deeper on the outside and inside of the lobe, but become much more shallow anteriorly and posteriorly, a condition which suggests that two paired furrows are represented on the glabella anterior to the basal glabellar furrow. A flat, slightly curved triangular area occurs external to the lobe, extends to the axial furrow, and reaches forwards to the front of the oval lobe. The breadth of the glabella attains a maximum at the level of the front of the fixed cheeks, and thence suddenly tapers and passes into the spine which extends almost horizontally forwards; the glabella, in many individuals, shows a faintly defined median carina, and round the glabellar front there is a series of irregular. narrow grooves. The occipital ring is short and there is a suggestion of lateral lobes. The fixed cheeks are large, gently convex, and show a series of faint grooves distributed mainly over the anterior surface; posterior border furrow strong and directed horizontally outwards from the occipital furrow.

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* This is the specimen figured by La Touche (see explanation of fig. 5 on Plate V., p. 171).

The eyes are undeveloped. A sigmoidally curved facial suture passes on to the dorsal surface at the level of the front of the oval lobe on the glabella, and sweeps at first inwards and then outwards to cut the posterior margin at an angle of about 32°. The free cheeks are narrow and prolonged backwards into spines, which, after curving outwards, then trend inwards, becoming subparallel to the axis of the test (Pl. V. fig. 7, GSM: 69895); the spines are grooved and long, extending nearly a centimetre beyond the end of the pygidium.

The parallel-sided thorax consists of six segments. Axial furrows are deep and the axial rings carry nodular lateral lobes. The almost flat and parallel-sided pleuræ extend horizontally outwards, are rounded externally. and each clearly shows a simple pleural furrow. The pleuræ of the first segment are abruptly truncated at their antero-external corner by a straight, backwardly and outwardly directed edge corresponding to the facet.

The pygidium is triangular in shape; a pronounced axis reaches the posterior border, which is deflected vertically. The axis shows about eighteen curved rings and furrows, of which the former terminate in faint lobes. The number of pleuræ varies from one to five (Pl. V. figs. 5 & 7, BM: In 37306 & GSM: 69895), but in all cases the first pleura is strongly marked off by a deep curved groove originating at the front of the axial furrow; when present subsequent pleural grooves are much weaker.

Geological Horizons and Localities.—The species is known in Shropshire from the *D. bifidus* Zone and is plentiful in the Upper Hope Shales of Hope Quarry, Hope stream, immediately above Fox Inn, stream 1¼ miles N.E. of Knotmoor, stream running through Overton Rough (Ruckley Farm), and was obtained in abundance from Hope Shales thrown out from the boat-level adit, Brookless Coppice, Leigh; in shales hardened by dolerite intrusion in quarry S. of road near Grimmer Cottage, Leigh, and from a small hill N.E. of High Plantation, Lordstone Lane, Leigh: from shales interbedded in the Stapeley Volcanic Group at Ritton Castle, Tasgar Quarry, Nynd Farm, streams west of Pentirvin and also Bromlow Callow, roadside section at Leigh Farm, and in Lordstone Lane south-west of Leigh Manor and also directly west of Knotmoor Farm; from tuffs belonging to the Stapeley Volcanic Group at Pentirvin and Whitsburn Plantation; and from Stapeley Shales exposed in the stream north-east of Ganderbeach.

Lectotype.—Portlock used two syntypes for his description (1843, pl. i. B, figs. 1 & 2); only one of these can now be definitely traced (fig. 2), and is here chosen as the lectotype (Free Public Museum, Liverpool).

Remarks.—*Ampyx mammillatus* (Sars, 1835, p. 335, pl. viii. figs. 4 *a–d*) is closely allied to var. *austini*, and the two forms may indeed be identical; the variety is retained here because the figured pygidium of *A. mammillatus* (Sars, pl. viii. fig. 4 *d*; Oslo Museum, no. 56393) shows a series of faintly impressed grooves probably delineating the pleuræ, the pleural lobes are punctate, and the border is apparently more tumid.

A. nasutus (Dalman, 1826, p. 279, pl. v. figs. 3 *a–c*, and Angelin, 1854, p. 81, pl. xl. figs. 4–4 *a* *) is similar to our variety. Dr. Hägg informs me that the specimens described by Dalman and by Angelin cannot be traced, but I have been able to examine material collected probably from Öland. In *A. nasutus* the glabella overlaps the anterior border much more than in var. *austini*, the glabellar spine, which is circular in cross-section, is strongly inclined upwards, the free cheeks are larger and their spine much more robust, the pygidial axis is broader and tapers more gradually, and the pygidium is shorter relative to the breadth †.

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* The specimen figured by Angelin on pl. xvii. figs. 1–1 *c* is probably distinct from *A. nasutus*.

† These differences have been determined by reference to specimen no. Ar 8881, Riksmuseum, Stockholm.

The two specimens that Hicks used in defining *Ampyx salteri*, from the Llanvirn of St. David's. Pembrokeshire, are crushed, and much of the detail is lost through the distortion and compression they have suffered (Hicks, 1875, p. 182, pl. x. figs. 7 & 8, SM: A 15592 and BM: I 352). Two features apparently may separate *A. salteri* and *A. mammillatus* var. *austini*. There are three pairs of pleuræ on the pygidium of *A. salteri* (Pl. V. fig. 8) and only one pair on most specimens of var. *austini*; other specimens, however, show that while the first pleural pair is well defined in the latter variety, subsequent pleuræ may also occur, but they are usually more faintly impressed, and apparently may range in number from one to five. Thus no separation of the two forms can be effected on the number of pleuræ on the pygidium. One of the types of *A. salteri* exhibits a pronounced tumid border to the pygidium (Pl. V. fig. 8), and this condition has apparently arisen through compression of the pygidial margin, which was once probably vertical; probably it has no systematic significance. *A. mammillatus* var. *austini* is here thought to be the same as *A. salteri*. the former name having priority, but since there is some slight doubt *A. salteri* is considered only as a probable, and not as an absolute, synonym.

Reed (1903. p. 23, pl. iii. fig. 14) has recorded *A. mammillatus* var. *austini* from the Balclatchie Group of Ardmillan, Girvan, but the presence of two pairs of glabellar furrows in front of the pair of lateral lobes suggests that the specimen is probably incorrectly identified. Furthermore, Reed (1931, p. 4) is wrong in referring the variety to *Raphiophorus*, for that subgenus possesses five thoracic segments and not six as in *Ampyx* proper.

A. mammillatus var. *austini* is similar to *A. nudus* (Murchison, 1839. p. 660, pl. xxiii. fig. 5), but can readily be differentiated because the grooves are undeveloped in the posterior surface of the pleural lobes of the pygidium.

Ampyx nudus (Murchison).

1839. *Trinucleus nudus* Murchison, p. 660, pl. xxiii. fig. 5.
1849. *Ampyx nudus* Forbes, pp. 1–4, pl. x.
1851. *Ampyx nudus* McCoy, p. 148.
1873. *Ampyx nudus* Salter, p. 32.
1925. *Ampyx nudus* Raymond, p. 31.

Murchison obtained the type-specimens (GSM : 6835) from Pencerrig, Builth, from rocks of Llandeilo age ; Forbes, when revising the species, illustrated his description by idealized drawings which in some respects may be misleading. The original specimens that Murchison used are refigured in the present paper (Pl. V. fig. 9), but a full description is considered unnecessary. *A. nudus* is characterized by the presence of at least nine pleuræ on each side of the pygidium ; in the type-specimens the facial suture does not apparently pass on to the dorsal surface, yet other material from Builth would indicate that this suture just transgresses on to that surface.

Geological Horizon and Localities.—Uncommon in Shropshire, being known by a few specimens from shales interbedded in the Stapeley Volcanic Group at Tasgar (Pl. V. fig. 10, Geology Department, Birmingham University) and from the stream to the west of Bromlow Callow.

Remarks.—*Ampyx latus* (McCoy, 1849, p. 410 ; 1851, p. 147, pl. 1 F, fig. 13, and 1854, p. 148, SM : A 15620) has been given by Woods as a synonym of *A. nudus* (1891, p. 139). McCoy's species is certainly the broader form and shows five thoracic segments. *Raphiophorus* and *Lonchodomas* carry five segments and *Ampyx* six (Raymond, 1925, pp. 29–31) ; "*A.*" *latus* should be referred to one of the former genera assuming that they are distinct one from the other. Raymond stresses the presence of a prismatic spine in *Lonchodomas* and a spine which is circular in cross-section in *Raphiophorus*, but since this structure is not preserved in the holotype of "*A.*" *latus* the probable generic designation of this species cannot be determined with certainty.

Family **Cheiruridæ** Corda.

PLACOPARIA Hawle & Corda, 1847.

Placoparia zippei (Boeck).

1825. *Trilobites sulzeri*, var. β, Sternberg, p. 82, pl. i. fig. 3.
1828. *Trilobites zippei* Boeck, p. 38, pl., fig. 26.
1833. *Trilobites zippei* Sternberg, p. 50.
1843. *Conocephalus zippei* Goldfuss, p. 557.
1847. *Placoparia zippei* Hawle & Corda, p. 129, pl. vi. fig. 71.
1852. *Placoparia zippei* pars, Barrande, p. 803.
1872. *Placoparia zippei*, Barrande, p. 106, pl. viii. figs. 28–42.
1875. *Placoparia cambriensis* Hicks, p. 186, pl. ix. figs. 1 & 2.

1875. *Calymene hopkinsoni* Hicks, p. 187, pl. x. fig. 4.
1909. *Placoparia cambrensis* Strahan & others, p. 30.
1914. *Placoparia cambrensis* Strahan & others, pp. 27 & 28.
1918. *Placoparia zippei*, Novák & Perner, pp. 42 & 46.
1926. *Placoparia zippei* Bouček, p. 2.
1931. *Placoparia cambrensis* Shirley, p. 17.

The following description is founded almost entirely upon a specimen from Ritton Castle, in which the cephalon. thorax, and pygidium are disarticulated (Pl. VI. fig. 2. BM : I 4535).

The cephalon is 2·7 mm. long and 6·5 mm. broad *. The glabella is gently convex, measures at its base approximately one-third the total cephalic breadth, expands anteriorly, and is delimited by almost straight, divergent, pronounced axial furrows ; the latter curve inwards in front of the glabella and become less deep mesially. The second and third pairs of glabellar furrows are disposed horizontally, but the furrows of the first pair are directed inwards and backwards at about 45°. The lateral lobes occupy about one-third the glabellar breadth on each side ; the lobes of the second and third pairs are rounded, those of the first subangular, while the frontal lobe is much less wide than the total breadth of the glabella at this level. The occipital ring is convex, possesses faint lateral lobes, and is separated from the glabella by a strong occipital furrow. The anterior border is convex, somewhat angular in transverse section, and clearly separated from the glabella ; no transverse grooves (possibly for the reception of the pygidial pleuræ when the animal was enrolled) have been seen on the underside of the border such as Verneuil and Barrande have described in *P. tourneminei* (1855, p. 969, pl. xxiii. figs. 6 & 6 *a*). The fixed cheeks are large, gently convex, and carry a deep furrow marking off a flat posterior border which becomes more pronounced laterally. Opposite the level of the middle of the first lateral glabellar lobe a deep, horizontal furrow passes outwards from the axial furrow ; it bounds the hinder edge of a laterally elongated ridge which is defined in front by the anterior border furrow. This ridge curves slightly backwards along its outer course. The outer and inner surfaces of the dorsal test are granulated, finely so on the glabella and more coarsely on the fixed cheeks.

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* Larger specimens are known measuring up to 6 mm. long and 15 mm. broad.

The posterior extremity of the facial suture cuts the cephalic margin (where it makes a notch in the outline) in front of the posterior border (Pl. VI. fig. 1; GSM: 69896), then swings inwards and forwards, conforming approximately with the lateral border furrow, but, just before the axial furrow is reached, and in front of the elongated ridge on the fixed cheek mentioned above, it turns outwards to cut the anterior margin. The free cheeks are very narrow, granulated, and actually consist in dorsal view of little more than the convex lateral border. There is no evidence of eyes.

The thorax comprises twelve segments (Pl. VI. fig. 2, BM: I 4535). Axis is gently tapered posteriorly and axial rings carry lateral lobes. Pleuræ extend horizontally outwards to the fulcrum, where they turn sharply downwards; they exhibit poorly developed anterior and posterior bands, separated by a powerful, horizontally aligned ridge which occupies much of the length of the pleura. It is not known if the pleural terminations are pointed, but they probably are.

The pygidium is extremely small relative to the size of the complete individual; the axis is conical in shape, with five segments, of which the posterior one is minute. There are four spatulate pleuræ each with a pronounced ridge similar to that described on the thoracic segments.

Geological Horizons and Localities.—The species is rare; it occurs in the Hope Shales at Hope Rectory Quarry, in the stream south of the Minsterley–Habberley lane 510 yards E. 10 N. of New House Farm, in shales which have been altered and hardened by the Dysgwylfa albite dolerite at the engine-house of the large quarry about ½ mile N.W. of Pitcholds, in the topmost Hope Shales exposed in the stream flowing through the south-eastern portion of Overton's Rough near Leigh Manor; one specimen is available from Ritton Castle and was probably collected from the Hope Shales. A *Placoparia*, probably to be referred to this species, has been collected from the Mytton Flags, *D. hirundo* Zone, at the roadside quarry about 330 yards north-north-east of Tankerville Mine (GSM: RR 273).

Remarks.—The differences between the described species of *Placoparia* are difficult to assess. *P. tourneminei* (Rouault, 1846, p. 320, pl. iii. fig. 4; Salter, 1853, p. 159, pl. vii. figs. 2 *a–c*; Verneuil & Barrande, 1855, p. 968, pl. xxiii. figs. 6, 6 *a–c*) seems to be separated by the possession of no more than eleven thoracic segments, whereas all other forms are provided with twelve in the adult condition. *P. grandis* (Hawle & Corda, 1847, p. 127), as figured by Barrande (1872, p. 104, pl. ii. figs. 24 & 25, and pl. viii. figs. 43–49), has the frontal lobe of the glabella confluent with the anterior border, and the anterior border furrow is practically obliterated; thus at first sight the frontal lobe appears to be broader than any other subdivision of the glabella and to extend as far as the cephalic margin, but actually it is a compound structure: the margin of the free cheek is denticulate. *P. zippei* (Boeck, 1828, p. 38, plate, fig. 26; Barrande, 1872, p. 106, pl. viii. figs. 28–42) is found in older beds than those which yield *P. grandis*, and differs in the frontal lobe being narrow and clearly delimited by a furrow from the tumid anterior border, by the smooth margin of the free cheeks, by the slightly different directions of the glabellar furrows, and by its much more delicate proportions. Klouček (1917, p. 14) proposed *P. zippei* var. *tumida* for forms from the $Dd_{1\gamma\delta}$ beds, and founded its separation on the presence of a transversely grooved margin to the anterior ventral surface of the cephalon; this structure, however, is known from other representatives of *Placoparia*, and appears to have no systematic value. *P. cambriensis* (Hicks, 1875, p. 186, pl. ix. figs. 1 & 2, SM: A9578 & GSM: 35263), from the Llanvirn beds of Pembrokeshire, is frequently badly distorted, and the two syntypes are refigured here (Pl. VI. figs. 3 & 4). Hicks compared *P. cambriensis* with *P. zippei*, but I suspect that he referred to Barrande's description and figures of 1852 and not to this author's much more detailed and better illustrated account of 1872. It so happens that in 1852 Barrande held the opinion that *P. grandis* was a synonym of *P. zippei*, and he actually figured specimens which in 1872 he referred to *P. grandis* when he recognized this species. Consequently Hicks was quite correct when he noticed differences between

P. cambriensis and what in 1852 was described as *P. zippei*. In effect, however, his comparisons were made with *P. grandis* and not with *P. zippei*. The comparison of *P cambriensis* and the true *P. zippei* shows that the species are probably identical, except that the Welsh form (and other material referred to *P. cambriensis*) is invariably smaller: even this difference disappears when comparison is made with the specimen originally figured by Sternberg. *P. cambriensis* thus becomes a synonym of *P. zippei*, and yet another species found in the $D_{1\gamma}$ beds of Bohemia is recorded from the Bifidus beds of South Wales and of West Shropshire (Stubblefield, 1939, p. 54).

Delgado (1908, pp. 33 & 57) apparently considered *P. tourneminei* as a synonym of *P. zippei* of Boeck, and different from *P. zippei* as interpreted by Barrande, but the author does not give his reasons for this statement, and I have been unable to substantiate his opinion.

PLACOPARINA, gen. nov.

Diagnosis.—General outline ovate. Cephalon subsemicircular; glabella expands anteriorly, three pairs curved furrows, basal pair almost isolating lobes, three pairs lateral lobes and frontal lobe; axial furrows almost straight, divergent, confluent with preglabellar furrow; axial ring, posterior border and furrow; fixed cheeks large, carry anterior horizontally disposed ridge reaching facial suture; suture just appears on dorsal surface, describes a course as in *Placoparia*, makes invagination into fixed cheek at postero-lateral corner; eyes apparently undeveloped; free cheeks unknown. Thorax twelve segments, axis tapering, pleuræ horizontal, deflected downwards at fulcrum, narrow anterior and posterior bands separate marked ridge, punctæ in grooves in front of and behind ridge. Pygidium small, three axial rings, small terminal piece, three pairs faintly grooved pleuræ, spatulate spines.

Genotype.—*Placoparina sedgwicki*.

Placoparina sedgwicki (McCoy).

1849. *Cryphæus sedgwicki* McCoy, p. 406.
1851. *Ecoptochile sedgwicki* McCoy, p. 155, pl. 1 F, fig. 14.
1854. *Cryphæus* (*Ecoptochile*) *sedgwicki* McCoy, p. 145.
1864 *a*. *Cheirurus* (*Eccoptochile*) *sedgwicki* Salter, p. 73, pl. v. fig. 17.

1881. *Eccoptochile sedgwicki* Schmidt, p. 124.
1884. *Cheirurus sedgwicki* La Touche, p. 56, pl. ii. fig. 41.
1896. *Eccoptocheile sedgwicki* Reed, p. 120.

The three specimens employed for the following description are all slightly distorted. The largest cranidium has a calculated length of 19 mm. and is 40 mm. broad.

The glabella is gently convex, 16 mm. long, 11 mm. broad at its base, and gradually increases to a maximum breadth of 14 mm. (Pl. VI. fig. 8, BM: In 37338). It is defined by deep and straight axial furrows which coalesce anteriorly and constitute an equally deep preglabellar furrow. Three lateral glabellar furrows occupy on each side one-third the glabellar breadth, and all of them are curved and directed obliquely backwards: the third furrow almost isolates an elongated third lateral glabellar lobe. the first and second lobes are parallel-sided. and the frontal lobe is less broad than the maximum width of the glabella. The glabella apparently overhangs the anterior border. and a preglabellar field is absent. The occipital ring is pronounced. The convex fixed cheeks are large and carry a deep posterior border furrow: the border enlarges externally. Opposite the first glabellar furrow and close to the axial furrow a short transverse ridge is developed which is defined in front by the antero-lateral border furrow and terminates against the facial suture. The course of the facial suture is not known all along its length, but it certainly causes a notch to be formed in the postero-lateral edge of the cranidium (Pl. VI. fig. 9. BM: In 37329); a similar notching of the outline is present in *Placoparia zippei*. The suture must swing forwards almost parallel with the presumed outer edge of the free cheek, and it cuts the antero-lateral margin in front of the transverse ridge already mentioned. The free cheek is unknown, but it must have been exceedingly narrow, and eyes were apparently not developed. The ornamentation of the surface of the internal cast comprises numerous pits; on the external mould these are represented by granules which are interspersed with innumerable punctæ, the latter alone being seen on the glabella.

The thorax consists of twelve segments (Pl. VI. fig. 7, GSM: 69897). The axis tapers gently posteriorly. Pleuræ extend horizontally outwards to the fulcrum, where they are deflected downwards and obliquely backwards; narrow anterior and posterior bands are separated by a markedly convex, transverse ridge, and small punctæ are present in the grooves at the front and back of this ridge. The terminations of the pleuræ are bluntly pointed.

The pygidium is small and shows three clear axial rings and a small terminal piece reaching to the posterior margin. Three pairs of faintly grooved pleuræ extend outwards and end in free, spatulate, backwardly directed spines.

Geological Horizons and Localities.—The species is very rare. Two cranidia and a cranidium with attached thoracic segments are known from shales interbedded in the Stapeley Volcanic Group at Tasgar Quarry and Nynd Farm. One complete individual was collected in Brookless Coppice, Leigh, from shales thrown out from a boat-level which, twenty-one years ago, was being driven from this locality towards Roman Gravel Mine, Hope; the geological subdivision is consequently unknown, but the lithology of the rock suggests Hope Shale; it is certainly from the Bifidus Beds, as are the two cranidia.

Holotype.—SM: A 15616.

Remarks.—*Placoparina sedgwicki* *, of which the holotype is figured here (Pl. VI. figs. 5 & 6, SM: A15616), has been referred by most authorities to *Eccoptochile*, a subgenus of *Cheirurus*, of which the type is *Cheirurus* (*Eccoptochile*) *clavigera* (Hawle & Corda, 1847, p. 129, pl. vi. fig. 69). *P. sedgwicki* differs fundamentally from *Eccoptochile* because apparently it has no eyes, possesses an almost marginal facial suture, and shows on the fixed cheek a characteristic anterior transverse ridge and a notch in the postero-lateral outline; in these respects it approaches *Placoparia*. The form shows affinities with *Cheirurus* in the structure of the thorax and pygidium and in the typical arrangement of the glabellar furrows. *Placoparina sedgwicki* thus occupies an intermediate position between *Placoparia* and *Cheirurus*, but can be referred to neither genus; the new genus *Placoparina* is thus proposed. *Placoparina* can be placed in the subfamily Pliomerinæ Raymond, but the structure of the glabella, thorax, and pygidium suggests that it links the Pliomerinæ with the Cheirurinæ. From *Pliomera* Angelin, *Pliomerops* Raymond, and *Protopliomerops* Kobayashi it is readily distinguished in the structure of the post-cephalic test, in the arrangement of the glabellar furrows, in the diminutive free cheeks, and in the probable absence of eyes.

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* Dr. Elles informs me that the holotype found "2 miles north of Builth" comes from a locality which is almost certainly in beds belonging to the Zone of *Glyptograptus teretiusculus*.

Reed (1896, p. 120) has suggested that *Cheirurus pectinatus* Salter MS. is closely allied to *P. sedgwicki*: the original specimens (GSM: 35241 & 35242) are very indefinite, but there appears to be a moderately long spine at the genal angle. *C. pectinatus* has not been described or figured, and is better ranked as a *nomen nudum*, particularly when its unsatisfactory preservation is taken into consideration.

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EXPLANATION OF THE PLATES.

PLATE V.

Figs. 1–3. *Agnostus morei* Salter (see p. 155).

Fig. 1. Internal cast of cephalon, the holotype (GSM: 8699), ×4. Hope Shales, *D. bifidus* Zone, of Cefn Gwynlle.

Fig. 2. Incomplete pygidium (GSM: 69914), ×3. Hope Shales of Josey's Wood stream 400 feet south-east of where it joins the Hope Dingle Brook, Wagbeach, near Minsterley.

Fig. 3. Thoracic segment and incomplete pygidium, the latter having been inverted during entombment (SM: A 15599), ×5. Llanvirn beds of Long Plantation Cutting, Haverfordwest.

Figs. 4–7. *Ampyx mammillatus* Sars var. *austini* (Portlock) (see p. 157).

Fig. 4. Internal cast of lectotype figured by Portlock (1843, pl. i.B, fig. 2, Free Public Museum, Liverpool), ×1·85. Llandeilo beds of Newton Head, Waterford.

Fig. 5. External mould illuminated to appear as an internal cast: figured by La Touche (1884, pl. ii. fig. 34, BM: In 37306), ×1·5. Shales interbedded in the Stapeley Volcanic Group, *D. bifidus* Zone, Tasgar Quarry. The frontal portion of the glabella is drawn out more than in the lectotype figured above, but these different appearances are frequently due to longitudinal foreshortening and to the glabella being preserved as a cast and the spine as a mould.

Fig. 6. Internal cast of same individual (BM: In 37306), × 1·5.

Fig. 7. External mould, showing the cranidial spines and two pairs of pronounced pygidial pleuræ (GSM: 69895), × 1·5. (?) Hope Shales thrown out from boat-level adit, Brookless Coppice. Leigh, *D. bifidus* Zone.

Fig. 8. *Ampyx salteri* Hicks (see p. 161). Distorted and compressed internal cast, syntype, figured by Hicks (1875, pl. x. fig. 8. BM: I 352), × 1. Llanvirn Beds of Whitesand Bay, St. David's, Pembrokeshire.

Figs. 9–10. *Ampyx nudus* (Murchison) (see p. 161).

Fig. 9. Internal casts, the holotype specimen, figured by Murchison (1839, pl. xxiii. fig. 5, GSM: 6835), × 1·5. Llandeilo beds of Pencerrig, Builth.

Fig. 10. Internal cast, showing characteristic pygidium (Geology Museum, University of Birmingham), × 1·5. Shales interbedded in the Stapeley Volcanic Group, *D. bifidus* Zone. Tasgar Quarry.

PLATE VI.

Figs. 1–4. *Placoparia zippei* (Boeck) (see p. 162).

Fig. 1. Internal cast, showing the free and fixed cheeks, the facial suture, the characteristic notch at the posterior corner of the fixed cheek and also the transverse ridge on its anterior surface (GSM: 69896), × 1·8. Note that the frontal lobe of the glabella and the anterior border are broken through and slightly distorted. Hope Shales, *D. bifidus* Zone, which have been altered and hardened by the Dysgwylfa albite dolerite at the engine-house of the large quarry about ½ mile N.W. of Pitcholds.

Fig. 2. Disarticulated cranidium, thorax (of which only ten segments are seen), and pygidium (BM: I 4535), × 3. Hope Shales, *D. bifidus* Zone, Ritton Castle.

Fig. 3. Syntype of *Placoparia cambriensis* figured by Hicks (1875, pl. ix. fig. 2, GSM: 35263), × 1. Llanvirn beds of Llanvirn Quarry, near Abereiddy, Pembrokeshire.

Fig. 4. Another syntype of *P. cambriensis* figured by Hicks (pl. ix. fig. 1, SM: A 9578), × 0·9. Same locality and horizon as previous specimen.

Figs. 5–9. *Placoparina sedgwicki* (McCoy) (see p. 166).

Fig. 5. Internal cast, holotype, figured by McCoy (1851, pl. 1. F, fig. 14. SM: A15616*a*), × 1. Llandeilo beds, *G. teretiusculus* Zone, 2 miles north of Builth.

Fig. 6. Part of external mould of holotype, to show the pygidium: the axial rings and pleuræ of two thoracic segments are also present (SM: A 15616*b*), × 1.

Fig. 7. Almost perfect specimen (GSM: 69897), × 1·8. (?) Hope Shales thrown out from boat-level adit, Brookless Coppice, Leigh. *D. bifidus* Zone.

Fig. 8. Cranidium, showing the characteristic arrangement of the glabellar furrows and also the broad, pitted, fixed cheeks, but no eyes are present (BM: In 37338), × 1. Shales interbedded in the Stapeley Volcanic Group, *D. bifidus* Zone. Tasgar Quarry.

Fig. 9. Cranidium tilted to one side, to show the broad fixed cheek and the typical notch at the postero-external side; the irregularity on the fixed cheek is accidental (BM: In 37329), × 1·6. Same locality and horizon as previous specimen.

XIII.—*Twenty eight new Generic Names in Orthoptera.*

By B. P. Uvarov, D.Sc., British Museum (Natural History).

The present paper is a direct continuation of the list of twenty-four new generic names in Orthoptera proposed to replace preoccupied ones and published in this journal (Ann. & Mag. Nat. Hist. ser. 11. vol. iii. 1939. pp. 457–459 and 637). The second list covers the genera beginning with the letters D to L inclusive, which are contained in the second volume of S. A. Neave's 'Nomenclator,' and other lists will be produced in due time.

Dædalus Redtenbacher, 1891 (Tettigoniidæ), preoccupied by *Dædalus* Rouault, 1850 (Fossil, *inc. sedis*) renamed **Dædalellus**, n. n.

Decimia Stal, 1877 (Mantidæ), preoccupied by *Decimia* Walker, 1856 (Lepidoptera), re-named **Decimiana**, n. n.

Dicellura Rehn & Hebard, 1915 (Tettigoniidæ), preoccupied by *Dicellura* Haliday, 1865 (Thysanoptera), re-named **Dicellurina**, n. n.

Dictyoblatta Hanitsch, 1932 (Blattidæ), preoccupied by *Dictyoblatta* Handlirsch, 1906 (Archimylacridæ), re-named **Dictyoblattella**, n. n.

Dina Redtenbacher, 1906 (Phasmidæ), preoccupied by *Dina* Blanchard, 1892 (Vermes), re-named **Dinophasma**, n. n.

Donusa Stål, 1875 (Phasmidæ), is preoccupied by *Donusa* Nordmann, 1864 (Crustacea), but according to Karny (Treubia, iii. 1923, p. 234), Stål's genus is a synonym of *Bacunculus* Burmeister, 1838, and no new name is required.

Ectobiella Adelung, 1917 (Blattidæ), preoccupied by *Ectobiella* Bruyne, 1889 (Protozoa), re-named **Ectobiola**, n.n.

Eluma Bruner, 1920 (Tettigoniidæ), preoccupied by *Eluma* Budde-Lund, 1885 (Isopoda), re-named **Elumiana**, n. n.

Episcopus Saussure, 1873 (Mantidæ), preoccupied by *Episcopus* Brisson, 1760 (Aves), re-named **Episcopomantis**, n. n.

Eremobia Serville, 1839 (Acrididæ), is preoccupied by *Eremobia* Stephens, 1829 (Lepidoptera), but a later name *Tmethis* Filber, 1853, is available and in use for the genus.

Ernodes Redtenbacher, 1908 (Phasmidæ), is preoccupied by *Ernodes* Wallengren, 1891 (Trichoptera), but no new name is required as Redtenbacher's genus is synonymous with *Echetlus* Stål, 1875 (see Karny, Treubia, iii. 1923, p. 238).

Fortunata I. Bolivar, 1908 (Acrididæ), is preoccupied by *Fortunata* Chun, 1889 (Crustacea), but no new name is required since Bolivar's genus is synonymous with *Wernerella* Karny, 1907 (see Kirby, Syn. Cat. Orth. iii. p. 582; and I. Bolivar, Mem. Soc. Esp. Hist. Nat. viii. 5. 1914, p. 190).

Fryeria I. Bolivar, 1912 (Gryllidæ), preoccupied by *Fryeria* Gray, 1853 (Mollusca), re-named **Fryerius**, n. n.

Gabonia I. Bolivar, 1906 (Tettigoniidæ), preoccupied by *Gabonia* Jacoby, 1893 (Coleoptera), re-named **Gabonella** n. n.

Gatunia Hebard, 1927 (Tettigoniidæ), preoccupied by *Gatunia* Rathbun, 1918 (Crustacea), re-named **Gatunella**, n. n.

Gesonia Stål, 1878 (Acrididæ), preoccupied by *Gesonia* Walker, 1858 (Lepidoptera), re-named **Gesonula**, n. n.

Gryporhynchus Redtenbacher, 1891 (Tettigoniidæ), preoccupied by *Gryporhynchus* Nordmann, 1832 (Vermes), re-named **Gryporhynchium**, n. n.

Habra Brunner, 1891 (Tettigoniidæ), appears to be preoccupied by *Habra* Agassiz, 1846 (Mollusca), but the latter name is merely an emendation of *Abra* Lamarck, 1818, and therefore itself not valid.

Hancockia Kirby, 1914 (Tetrigidæ), preoccupied by *Hancockia* Gosse, 1877 Mollusca, re-named **Hancockella**, n. n.

Hectoria Tepper, 1889 (Tettigoniidæ), is preoccupied by *Hectoria* Castelnau, 1873 (Pisces), but the genus is synonymous with *Alectoria* Brunner, 1879, which name is used for it.

Henia Giglio-Tos, 1898 (Acrididæ), preoccupied by *Henia* Koch, 1847 (Myriapoda), re-named **Heniola**, n. n.

Heteroplana Kirby, 1903 (Blattidæ), preoccupied by *Heteroplana* Willey, 1897 (Vermes), re-named **Heteroblatta**, n. n.

Himerta Brunner, 1878 (Tettigoniidæ), preoccupied by *Himerta* Foerster, 1868 (Hymenoptera), re-named **Himertula**, n. n.

Homalaspis Brunner, 1895 (Tettigoniidæ), preoccupied by *Homalaspis* Milne-Edwards, 1863 (Crustacea), renamed **Homalaspidia**, n. n.

Idolum Saussure, 1869 (Mantidæ), preoccupied by *Idolum* Pfeiffer, 1856 (Mollusca), re-named **Idolomantis**, n. n.

Ischnopoda Grandidier, 1869 (Phasmidæ), preoccupied by *Ischnopoda* Stephens, 1835 (Coleoptera), renamed **Ischnophasma**, n. n. (The genus is taken here in the restricted sense according to Karny, Treubia, iii. 1923, p. 239.)

Isotima Brunner, 1878 (Tettigoniidæ), preoccupied by *Isotima* Foerster, 1868 (Hymenoptera), re-named **Isotimula**, n. n. This action is taken in spite of the fact that Kirby (Syn. Cat. Orth. ii. p. 399) listed *Paura* Karsch. 1888, as a synonym of *Isotima* Brunner, which would make *Paura* available. In my opinion, however, the African genus *Paura* is distinct from the Oriental *Isotima*, and the latter, therefore, requires a new name.

Karschia Brunner, 1891 (Tettigoniidæ), is preoccupied by *Karschia* Walter, 1889 (Arachnida), but is a synonym of *Drepanophyllum* Karsch, 1890, which name is used for the genus.

Kempiella Chopard, 1924 (Gryllidæ), preoccupied by *Kempiella* Mathews, 1913 (Aves), re-named **Kempiola**, n. n.

Lamarchus Stål, 1875 (Phasmidæ), preoccupied by *Lamarchus* Foerster, 1868 (Hymenoptera), re-named **Lamarchinus**, n. n.

Lamprella I. Bolivar, 1921 (Blattidæ), is preoccupied by *Lamprella* Reuter, 1890 (Hemiptera), but I abstain from introducing a new name, since I. Bolivar proposed *Lamprella* for a subgenus of *Hololampra* (*Phyllodromica*), and it appears questionable whether subgenera in that genus are sufficiently characterised to receive distinctive names (*cf*. Bey-Bienko, Ann. & Mag. Nat. Hist. ser. 11, vol. i. 1938, p. 243).

Lamprogaster I. Bolivar, 1878 (Tettigoniidæ), is preoccupied by *Lamprogaster* Macquart, 1843 (Diptera), but the name *Callicrania* I. Bolivar, 1898, is available and used for the genus.

Larandopsis Chopard, 1934 (Gryllidæ), preoccupied by *Larandopsis* Chopard, 1924 (Gryllidæ), re-named **Larandella**, n. n.

Leocrates Stål, 1875 (Phasmidæ), is preoccupied by *Leocrates* Kinberg, 1865 (Vermes), but no new name is required, as the genus is synonymous with *Heteropteryx* Gray, 1835.

Leprocaulus Redtenbacher, 1908 (Phasmidæ), preoccupied by *Leprocaulus* Fairmaire, 1896 (Coleoptera), re-named **Leprocaulinus**, n. n.

Leptomantis Giglio-Tos, 1915 (Mantidæ), preoccupied by *Leptomantis* Peters, 1867 (Amphibia), re-named **Leptōmantella**, n. n.

Lerina I. Bolivar, 1902 (Acrididæ), preoccupied by *Lerina* Walker, 1854 (Lepidoptera), re-named **Lerinnia**, n. n.

Lethus Rehn and Rehn, 1934 (Acrididæ), preoccupied by *Lethus* Say, 1837 (Hymenoptera), renamed **Mayamastax**, n. n.

Leurocerus Bruner, 1911 (Acrididæ), preoccupied by *Leurocerus* Crawford, 1911 (Hymenoptera), renamed **Leurohippus**, n. n.

Lilæa Stål, 1875 (Acrididæ), is preoccupied by *Lilæa* Walker, 1850 (Diptera), but the genus is in my opinion synonymous with *Bufonacris* Walker, 1871 (*syn. nov.*), and no new name is required.

Lindia Ramme, 1929 (Acrididæ), is preoccupied by *Lindia* Dujardin, 1841, and *Lindia* Blackburn, 1888 (Coleoptera), but no new name is required since Ramme himself suggested that his *Lindia* is synonymous with *Eucerohippus* Ramme, 1929, while my studies (as yet unpublished) prove that *Eucerohippus* Ramme, 1929 = *Taramassus* Giglio-Tos, 1907 (*syn. nov.*).

XIV.—*Preliminary Diagnoses of some new Species of* Mischocyttarus *Saussure* (*Hymenopt.*, Vespidæ). By O. W. Richards.

In order to allow my friend, Mr. J. A. Reid, to publish descriptions of Vespine larvæ, I wish briefly to describe some new species of the genus *Mischocyttarus* Sauss. A full revision of the genus is in active preparation. The types of all the new species are in the collection of the British Museum, and the following abbreviations are used to refer to collections where other specimens will be placed. B.M. = British Museum (Natural History). J.B. = Collection of Dr. J. Bequaert (Harvard). B. = Zoologische Museum d. Universität (Berlin).

Mischocyttarus collarellus, sp. n.

♀.—Closely allied to *M. collaris* (Ducke, 1904) but differs as follows:—Length (head + thorax + tergites 1–2) 11·0 mm. The yellow of the abdomen marked with distinct anterior brown bands. Sculpture of mesopleuron weaker, more granulate (less punctate). If the pronotal keel is produced to meet the posterior pronotal margin, the length of this production is less than distance separating the postero-dorsal angle of pronotum from the intersection of the imaginary production of the keel with the posterior margin (*i. e.*, pronotal keel shorter). In *M. collaris* (Ducke) these distances are equal or the second one is a little the shorter.

♂.—Antennal segment 13 less dilated, white beneath with distal quarter sharply black, cilia of segments 3–8 longer (in *M. collaris* (Ducke), segment 13 is more dilated and not or indistinctly black-marked beneath); also differs in same way as female.

Type ♀, British Guiana: Mazaruni Settlement, second growth forest, nest 295, 22. ix. 1937 (*Richards & Smart*) (B.M.). Allotype ♂, from same nest, emerged 27. ix. 1937 (B.M.). Paratypes, British Guiana: 3 ♀♀, 2 ♂♂, from same nest; same place, nest 277, 18. ix. 4 ♀♀, nest 297, 22. ix. 2 ♀♀, nest 318, 24. ix. 1 ♀, nest 344, 27. ix. 1 ♀; Cuyuni R., 3 miles from Kartabo, high forest, 20. ix. 1937, nest 284, 2 ♀♀, nest 285, 3 ♀♀; Potaro R., trail between Tukeit and Kaieteur, high forest, nest 141, 1. ix. 1 ♀, nest 183, 3. ix. 1937, 1 ♀ (*Richards & Smart*) (B.M.); Essequibo R., Moraballi Creek, high forest, 6. xi. 1929, 1 ♀ (Oxford Univ. Exped.) (B.M.). Panama: Trinidad Rio, 20. iii. 1912, 1 ♀ (*A. Busck*) (J.B.). Dutch Guiana: Paramaribo, 2 ♀♀ (*Heller*) (B.). Brazil, Guiana, Obidos. 15. v. 1905, 1 ♀ (*A. Ducke*) (B.) (det. as *M. collaris* by Ducke).

Dark Variety.

A few specimens have a colour-pattern resembling *M. collaris* var. *parallelogrammus* Zikán, 1935, except that the clypeus is yellow.

Specimens examined.—British Guiana : Mazaruni Settlement, second growth forest, nest 325, 25. ix. 2 ♀♀, nest 348, 27. ix. 1937, 2 ♀♀ (*Richards & Smart*) (B.M.) ; Moraballi Creek, high forest, nest 227, 11. viii. 1929, 1 ♀ (Oxford Univ. Exped.) (B.M.).

Some of the Guiana paratypes will be placed in my collection and in that of Dr. J. Bequaert.

Mischocyttarus superus, sp. n.

♀.—Length (head + thorax + tergites 1–2) 9·0–10·0 mm. Closely allied to *M. collaris* (Ducke, 1904) but differs as follows :—Abdominal tergites with distinct black anterior bands, clypeus and mesopleuron yellow, segment 5 of hind tarsi black (*M. collaris* var. *parallelogrammus* Zikán, 1935, which is similarly coloured, has the clypeus black marked and the mesopleuron black or ferruginous marked). Mesopleuron a little shining, distinct interspaces between the close fine punctures ; abdomen also more shining. Pronotal keel as in *M. collarellus*, sp. n., which, however, has a much duller mesopleuron.

♂.—Antennal segment 13 strongly dilated, white beneath with distal third sharply black ; segments 3–8 not ciliated ; also differs in same way as female.

Type ♀, British Guiana : Mazaruni Settlement, second growth forest, nest 296, 22. ix. 1937 (*Richards & Smart*) (B.M.). Allotype ♂, same place, nest 260, 14. ix. 1937 (*Richards & Smart*) (B.M.). Paratypes, same place, nest 296, 1 ♀, nest 260, 1 ♂, 3 ♀♀, nest 16, 3 ♀♀, nest 17, 1 ♀; nest 51, 1 ♀, 14. viii. 1937, nest 70, 21. viii. 2 ♂♂, 2 ♀♀, nest 107, 25. viii. 3 ♀♀, nest 134, 29. viii. 1937, 1 ♀ ; same place, in Colony House, 15. viii. 1937, 1 ♀ ; Bartica-Potaro Rd., 50–100 miles from Bartica, nest 150, 30. viii. 1937, 2 ♀♀ ; R. Potaro, trail between Tukeit and Kaieteur, nest 200, 6. ix. 1937, 1 ♀ (*Richards & Smart*) (B.M.).

Mischocyttarus cerberus Ducke, 1918.

Ducke (1918, Rev. Mus. Paulista, x. p. 371) mentions a variety *cerberus* du Buysson *in. litt.* of *M. surinamensis* (Saussure). The only description is the statement that the petiole is shorter and more cylindrical and the following locality records :—" Maranhão : Caxias. Connu du bas Amazon." Ducke did not designate holotypes, but it is probable that the Caxias specimen(s) is in the Museu Goeldi ; three specimens marked as types (det. Ducke) in the Museum national, Paris, come from Faro. A British Museum specimen (also det. Ducke) is also from Faro. The British Museum and the Paris specimens (referred to later, p.) belong to different species, and I propose to restrict the name *M. cerberus* to the British Museum species. It is the sole representative of a distinct species-group in the genus.

♀.—Mandibles with ventral edge sharp on proximal half. Clypeus as broad as long or nearly so. Malar space very short. Posterior ocelli separated from one another by rather more than their diameter, from eyes by about twice this distance. Occiput not margined. Pronotum with anterior margin strongly raised, preceded by a furrow whose posterior edge is laminate, no lateral fovea, pronotal keel moderately strong, nearly straight, laterally somewhat lobate. Anterior margin of proepisternum moderately raised and recurved. Sculpture of mesopleuron very weak ; dorsal division of metapleuron subacutely produced below. No proximal suture marking off a small ring on fore femur ; posterior tarsi with inner lobe of segment 3 much longer than outer lobe of segment 4, claws only moderately asymmetrical. Male mandibles with three teeth ; antennæ distally rolled with segments 9–12 thinner, but no longer than 8, 13 very long, as long as 6, no segment ciliate ; genitalia with membranous lobe of gonolacinia short and broad, ventral teeth of parameres ending before the ventral hooks, which are directed anteriorly, not laterally.

Colour Varieties.

1. Abdomen with each tergite banded with black and yellow, sternites entirely yellow. British Guiana .... var. *acheron*, var. n.

(Type ♀, British Guiana : Mazaruni Settlement, 1937 (*Richards & Smart*) (B.M.), nest 39, 17. viii. ; paratypes : nest 119, 27. viii. 2 ♀♀, nest 128, 28. viii. 1 ♀, nest 129, 28. viii. 1 ♀, flying 28. viii. 1 ♀, nest 265, 14. ix. 3 ♀♀, in Colony House, 17. ix. 1 ♀, nest 289, 21. ix. 2 ♀♀. Some paratypes will be placed in my and in Dr. J. Bequaert's collections.)

Each abdominal tergite either black or yellow. 2.

2. Abdominal tergites 2–6 black, sternites yellow. Surinam and Amazons .... var. *cerberus* Ducke.

(Specimens examined :—Brazil : Guiana, Faro, 3. ix. 1907, 1 ♀ (*A. Ducke*) (B.M.) (det. as *M. cerberus* by Ducke). Dutch Guiana : Paramaribo, ix. 1907, 1 ♂, 1 ♀ (*C. Heller*) (B.).)

Abdominal tergites and sternites 1–2 yellow ; tergites 3–6 black, half sternite 3 and all sternites 4–6 black. São Paulo. . . . . var. *styx*, var. n.

(Type and paratype ♀, Brazil : São Paulo, Dumont, from two nests, 11. vii. 1923 (*H. B. Cott*) (B.M.).)

Mischocyttarus œcothrix, sp. n.

A group of species quite closely allied to *M. cerberus* Ducke may be termed the group of *M. artifex* (Ducke). The group differs from the above definition of *M. cerberus* as follows :—Larger claw of hind tarsi not only much longer but considerably blunter and more truncate than the smaller one. Posterior ocelli usually closer together and to the eyes. Pronotal keel not lobate at sides. Anterior margin of proepisternum less raised and reflexed ; dorsal division of metapleuron variable. Dark mark surrounding ocelli usually with lateral processes (never in *M. cerberus* Ducke).

M. artifex (Ducke, 1914) is the only described species of this group, but I know of four others.

♂♀.—Close to *M. artifex* and similarly black and yellow, but pronotal keel at most only a little concave anteriorly. Malar space considerably shorter (one-quarter, not one-third, as long as width of antennal socket). Differs from other allied species in relatively broad abdominal tergite 1, larger size (length : head+thorax+tergites 1–2 10·0 mm., hamuli 10–11), pronotal keel ending abruptly laterally where it is a little reflexed, clypeus a little longer than broad, posterior ocelli separated by a little more than their diameter, by three times as much from eyes, wings with at least costal region dark yellow-brown, antennæ orange, abdomen light reddish brown, with posterior quarter or fifth of each tergite yellower.

Type ♀ and allotype ♂, British Guiana : Potaro Valley, Kaieteur savanna, high forest, nest 214, 6. ix. 1937 (*Richards & Smart*) (B.M.) ; Cattle Trail Survey, Canister Falls, xi. 1919, 1 ♂, 2 ♀♀ paratypes (*A. A. Abrahams*) (B.M. and B.G. Dept. Agric. (1 ♀)) ; Essequibo R., Moraballi Creek, wallaba bush, 12. xi. 1929, 1 ♀ paratype (Oxford Univ. Exped.) (B.M.).

Mischocyttarus synœcus, sp. n.

♂♀.—Closely allied to *M. œcothrix*, sp. n., but differs as follows :—Smaller species (length : head+thorax+tergites 1–2 9·0–10·0 mm., hamuli 7–11), abdominal tergite 1 narrower, posterior ocelli separated by a little more than their diameter, by two-and-a-half times as much from eyes, wings with costal region more hyaline, antennæ black or darkened dorsally, abdomen darker brown with posterior yellow bands less distinct, sometimes tergites 3–6 black, sternites yellow or 3–6 more or less black.

Type ♀, British Guiana : Potaro R., Amatuk, nest 147, 31. viii. 1937 (*Richards* & ; *Smart*) (B.M.). Paratypes, British Guiana : nest 147, ♀, Mazaruni Settlement, second growth forest, nest 320, 24. ix. 1937, 1 ♀, high forest, nest 72. 21. viii. 1937, 1 ♀ (*Richards* & *Smart*) (B.M.) ; Panama : Canal Zone, Barro Colorado Is., 31. i. 1929, 1 ♀ (*S. W. Frost*) (J.B.), 17. vii. 1924, 1 ♀ (*N. Banks*) (J.B.) ; Brazil : Guiana, Faro, 1 ♀ paratype, 1 ♂ allotype, 3. ix. 1907 (*A. Ducke*) (Paris), 26. viii. 1907, 1 ♀ (*A. Ducke*) (Paris).

The last three specimens, in which tergite 1 is brown and 3–6 black, are marked as types of *M. cerberus* (Ducke) (see above).

Mischocyttarus metœcus, sp. n.

The following new species belongs to the same group as *M. lecointei* (Ducke, 1904). It shares the following characters with that species :—Segment 3 of mid-tarsi nearly symmetrical. Inner lobe of segment 3 of hind tarsi not longer than outer lobe of segment 4, claws hardly asymmetrical. Malar space at most one-quarter as long as width of antennal socket. Posterior ocelli separated by less than their diameter, by twice to three times as much from eyes. Occiput not margined. Anterior margin of pronotum little raised, not preceded by a furrow, fovea absent or very minute, keel weak, gradually evanescent at sides, straight or anteriorly a little convex. Anterior margin of proepisternum little raised or reflexed. Mesopleuron very finely sculptured, more or less shining ; dorsal division of metapleuron ventrally acutely or more less obtusely produced. Male mandibles with four teeth ; antennal segments 10–13 elongate, subspirally rolled ; parameres unusually broad, ventral teeth very long, ventral hook long and acute, directed laterally at right-angles to long axis of paramere.

♂♀.—Differs from *M. lecointei* (Ducke) as follows:—Pronotal keel considerably stronger, acute throughout though not strongly raised. Dorsal division of metapleuron obtuse (not acute) ventrally. Black mark in front of pronotal keel one-third (not two-thirds) as wide as head. Length (head+thorax+tergites 1–2): ♀, 8·5–10·0 mm., ♂ 8·0–9·0 mm.

Type ♀, British Guiana: Mazaruni Settlement, second growth forest, nest 262, 14. ix. 1937 (*Richards & Smart*) (B.M.). Allotype ♂, British Guiana: Potaro R., Amatuk, nest 148, 31. viii. 1937 (*Richards & Smart*) (B.M.). Paratypes, British Guiana: Mazaruni Settlement, second growth forest, nests 261, 262, 263, 14. ix. 5 ♀♀, nest 319, 24. ix. 1 ♀, nest 337, 25. ix. 1937, 1 ♀ (*Richards & Smart*) (B.M.); Potaro R., Amatuk, nest 148, 31. viii. 1937, 2 ♀♀ (*Richards & Smart*) (B.M.); Dutch Guiana: Paramaribo, iii. 1909, 1 ♀ (darker than usual form) (*C. Heller*) (B.); Brazil, Amazonas, Barcellos, 23. vi. 1905, 1 ♂ (*A. Ducke*) (B.) (det. by Ducke as *M. lecointei*). Some paratypes will be placed in my and Dr. J. Bequaert's collections.

Group of Mischocyttarus surinamensis (*Saussure*).

One new species of this group cannot be described, since only a single late pupa is available. Mr. Reid will refer to it as "Species 10." It is apparently extremely similar in structure to *M. surinamensis* (Sauss.), but the nest is unique within the genus, being covered by an umbrella-shaped envelope, so that its sides are not formed by the actual cell walls.

Mischocyttarus immarginatus, sp. n.

The group of species allied to *M. ater* (Olivier, 1791) is principally distinguished as follows:—Anterior femur with no proximal ring marked off by a suture. Pronotum usually with a lateral fovea, keel strong and straight but centrally interrupted. Anterior margin of proepisternum strongly raised and reflexed. Occiput usually margined. Posterior ocelli separated by two-and-a-half diameters. Male with three mandibular teeth, intermediate antennal segments with elongate shining areas.

♂♀.—Differs from allied species in the following combination of characters :—Abdominal petiole about as long as hind femur, dorsally little convex, posteriorly distinctly expanded, spiracles little projecting, pubescence feeble. Segment 5 of front tarsi pale. Punctures of propodeum only moderately strong, anterior horizontal area moderately distinct, central furrow separated by one-third its length from postscutellum. Malar space one-quarter as long as width of antennal socket, posterior ocelli one-and-a-half times as far from eyes as from one another. Occiput (unlike all other species of group) without trace of margin. Species largely black, but pale markings include anterior margin of scutellum, posterior margin of postscutellum, two large marks on propodeum and bands on abdominal segments 1–2, which are pale yellow. The clypeus in part or entirely and, in the male, two spots on mesosternum ferruginous. Length (head+thorax+tergites 1–2) : ♀ 11·0–12·0 mm., ♂ 11·5 mm.

Type ♀. allotype ♂, Mexico : N. Yucatan (*Gaumer*) (B.M.). Paratypes. Mexico : Tepic, viii. 1 ♂ (*Goldsmith*) (J.B.) ; Guerrero, Tepetlan 3,000 ft., vi. 1 ♀ (*H. H. Smith*) (B.M.) ; Vera Cruz, Cordoba, no. 1342, 1 ♀ (*P. Rau*) (J.B.) ; Tamaulipas, Victoria, no. 1371, 5 ♀♀ (*P. Rau*) (J.B.) ; San Luis Potosi, Tamazunchale, no. 1358, 5 ♀♀, no. 1360, 1 ♂, 2 ♀♀, no. 1361, 4 ♀♀, no. 1363, 2 ♀♀, no. 1365, 1 ♀, no. 1366, 1 ♀, no. 1369, 1 ♀ (*P. Rau*) (J.B.) ; 35 kil. south of Tamazunchale, Canon de Gallana, no. 1326, 2 ♀♀ (*P. Rau*) (J.B.) ; Valles, no. 1328, 2 ♀♀ (*P. Rau*) (J.B.) ; 50 kil. south of Valles, Hiuchihuyan, no. 1373, 1 ♀ (*P. Rau*) (J.B.) ; Yucatan, Chichen Itza, vi. 1929, 1 ♀ (J.B.) ; Nicaragua : Managua, 1 ♂ (*Artemio-René*) (J.B.) ; U.S.A. : Philadelphia, at light in banana hold (from Mexico), 6. viii. 1935, 1 ♀ (*A. B. Wells*) (J.B.).

Some of the paratypes collected by Mr. Rau will be deposited in the British Museum and in my collection.

This species is one of several which have gone under the name *M. rufidens* (Saussure, 1854). The latter species was described from Cayenne and may be the same as *M. duckei* (du Buysson, 1908) ; it is not likely to occur in Mexico. I am describing *M. immarginatus* now in order to allow Mr. P. Rau to record observations which he has made on it.

XV.—*On the Mode of Growth of the Skeleton in Astræid Corals* *. By Prof. GEORGE MATTHAI, Sc.D. (Cantab.). University of Lahore.

A RENEWED survey of Astræid genera shows that budding, and therefore growth, are radial processes, new calicinal areas being formed in rows that radiate from the central primary calicinal area. This suggests the appended evolutionary tree of the genera, the details of which follow in the two series, Indo-Pacific and Atlantic †.

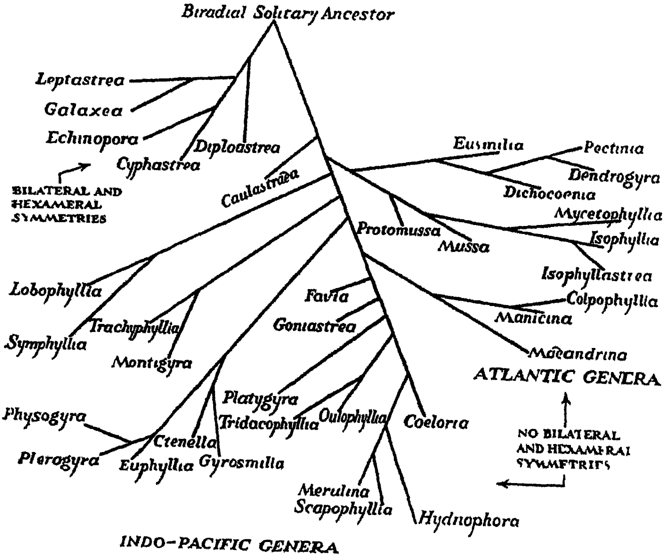

Diagram showing probable evolution of mode of growth of Astræid genera.

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* References to plates and figures are given in footnotes in thick and thin types; those without mention of date belong to 'A Monograph of the Recent Meandroid Astræidæ,' 1928.

Working in the Department of Zoology at Cambridge, I have had the advantage of discussing the subject of this paper with Prof. Stanley Gardiner.

† The condition of the columella does not seem to be related to the mode of growth of the Astræid skeleton. It exhibits the following conditions:—(1) unconnected centres as in *Caulastræa*, *Trachyphyllia*, *Protomussa*, *Isophyllastrea*; (2) centres connected by trabecular bridges as in *Oulophyllia*, *Mussa*, *Isophyllia*; (3) centres connected by a varying number of septal lamellæ as in *Symphyllia*, *Montigyra*, *Tridacophyllia*; (4) continuous and trabecular as in *Cœloria*, *Eusmilia*, *Dichocœnia*, *Manicina*; (5) continuous with centres marked as in *Scapophyllia*,

Caulastræa is the primitive genus. It has a narrow central base of attachment from which a cluster of comparatively short branches, formed by dichotomy, diverge radially outwards and bear corallites at their summits. The branches are free as in *C. furcata* Dana * and *tumida* Matthai †, or coalesced in places as in *echinulata* Ed. & H. ‡. In *Lobophyllia* growth is similar but without coalescence between branches, and shows an advance to the valley condition §, in that *L. corymbosa* (Forsk.) has short valleys and several corallites, *L. costata* (Dana) longer valleys and separate corallites very rare ||. When the valleys are usually continuous and sinuous as in *L. hemprichii* (Ehrbg.) and distinct corallites are absent, the corallum appears to be lobed, but without coalescence between the lobes ¶.

A further evolutionary stage has been reached by *Symphyllia*, in that the lobes fuse so as to form a massive corallum bearing a continuous or discontinuous valley. When, as in *S. radians* Ed. & H. **, the valley is continuous it consists of dichotomously branching rows of subsidiary calicinal areas that radiate from a primary area more or less central in position; the arrangement of calicinal rows is reflected on the non-calicinal surface. In *S. recta* (Dana) †† the valley has become discontinuous by the formation in places of transverse partitions. In *S. agaricia* Ed. & H. ‡‡ and *S. valenciennesii* Ed. & H. §§

Merulina; (6) continuous and lamellar as in *Ctenella, Platygyra*; (7) discontinuous without centres marked as in *Dendrogyra*; (8) absent as in *Euphyllia, Plerogyra, Physogyra, Gyrosmilia*, and *Mycetophyllia*.

In certain genera the columella may exhibit more than one condition:—*Hydnophora*, (1) in *H. grandis* and *rigida*, (4) in *H. exesa* and *contignatio*, (5) in *H. tenella* and (6) in *H. microconos*: *Lobophyllia*, (2) in *L. corymbosa*, (3) in *L. costata* and *L. hemprichii*: *Colpophyllia* (1), (3) and (8): *Mæandrina*, (4) in *M. cerebrum* and *clivosa*, (5) in *M. labyrinthiformis*: *Pectinia* (6) and (7).

* **44**, 5 *b*, 6; **45**, 3; **61**, 3; **62**, 6, 12.

† **72**, 5, 6.

‡ **45**, 4; **61**, 4.

§ **24**, 5; **25**, 5–8; **58**, 1; **60**, 4, 6; **71**, 5.

|| **29**, 1; **47**, 8; **58**, 2; **60**, 2; **62**, 15: Bedot, **17**, 76, 78, 79, 80.

¶ **23**, 5, 6; **29**, 2–4; **34**, 6; **54**, 8; **58**, 3; **60**, 5; **66**, 2: Bedot, **18**, 84–86.

** **31**, 3; **33**, 1; **54**, 7; **58**, 4: Bedot, **19**, 91.

†† **30**, 1–6: Bedot, **21**, 99, 100; **22**, 106.

‡‡ 1924, **6**, 4, 5: Bedot, **20**, 95.

§§ **32**, 1; **66**, 4.

more than one row of subsidiary calicinal areas occur in parts of valleys. In *Trachyphyllia* * the valley has a bilateral disposition, but there is no fusion of adjacent lobes although the valley may sometimes become sinuous †. The radial branching lobes are well marked on the non-calicinal surface. In *Montigyra* the radially bifurcating mode of growth is recognizable, although the colline has become discontinuous, and is marked on the non-calicinal surface, which has a stalk of attachment. The valley is continuous.

Euphyllia resembles *Lobophyllia* in comparable growth-forms, thus :—*E. glabrescens* (Cham. & Eys.) ‡, distinct radially bifurcating branches bearing short valleys and corallites=*L. corymbosa* (Forsk.) ; *E. turgida* Dana §, longer valleys and corallites rare=*L. costata* (Dana) ; *E. fimbriata* (Spgl.) ‖, valleys very sinuous, usually continuous, corallum appearing to be lobed but lobes free=*L. hemprichii* (Ehrbg.). The growth-size increases from *E. glabrescens* to *turgida* to *fimbriata*. *Plerogyra sinuosa* (Dana) agrees with *E. fimbriata* in growth-facies and size. The former has a varying quantity of vesicular peritheca between the bases of the branches ¶, while in *Physogyra* ** this deposition completely unites the walls of the radially bifurcating calicinal rows so as to give the appearance of collines. In *Ctenella* the valley is continuous, consisting of rows of calicinal areas radiating from the centre towards the periphery as in *C. laxa* Matthai ††, or subsequently becomes discontinuous and sinuous as in

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* *Callogyra formosa* Verrill has the same mode of growth as *T. geoffroyi* (Audouin), except that in the former walls of adjacent lobes are united (Bedot, **15**, 63–69 ; Verrill, **24**, 1, 2).

† **22**, 1–11 ; **23**, 1, 2, 5 ; **26**, 1 ; **60**, 1 ; **62**, 1–3, 7, 8, 11 : Bedot, **13**, 56–58.

‡ **44**, 4 ; **62**, 9 : Bedot, **8**, 23, 24.

§ **52**, 2.

‖ **40**, 1 ; **41**, 1, 2 ; **59**, 1 : Bedot, **9**, 28, 30, 31. In a large specimen of *E. fimbriata* in the British Museum the valley lobes radiate comparatively straight towards the periphery (**52**, 1). In the type-specimen of *E. picteti* Bedot, in which there are two sinuous valleys, and in that of *E. picteti* var. *flexuosa*, in which the valley is continuous and sinuous, the corallum has assumed the appearance of that of *Trachyphyllia geoffroyi* (Audouin), Bedot, **10**, 35, 36, 39, 40.

¶ **40**, 3 ; **41**, 3.

** **63**, 1 : Vaughan, 1907, **17** ; **18**, 1, 2.

†† **23**, 7 ; **49**, 4.

C. chagius Matthai[*]. *Gyrosmilia interrupta* (Ehrbg.) resembles *C. laxa* in growth-form, but the valley has become discontinuous.

In the early growth-stages of *Cœloria* the radially bifurcating mode of growth is clear[†]. In larger masses valleys are usually directed radially at the periphery, with or without terminal forking[‡]. In their central parts they have become so sinuous that it is difficult to determine any direction of growth[§], but sometimes comparatively straight valleys pass across the corallum from edge to edge in the midst of sinuous valleys.

Platygyra resembles the last in growth-form, but valleys are narrower and their peripheral terminations end radially, although sinuous in the older central region[||]. Sufficient evidence is not available for determining growth in *Oulophyllia*, especially as the valleys are very short, but it is unlikely that in this respect the genus differs from other astræids.

In *Tridacophyllia* the valley is continuous, consisting of the primary calicinal area more or less centrally placed and rows of subsidiary calicinal areas radiating towards the periphery. In early stages of *T. lactuca* (Pallas) the primary calicinal area is seen in the centre, but subsidiary calicinal areas have not yet made their appearance in the incipient radial lobes[¶]. In later stages the radially bifurcating mode of growth is clearly seen on the calicinal surface[**]. There is considerable variation in the depth of the valley, corresponding with the varying height of the discontinuous radial ridges. When two adjacent radial ridges converge proximally and meet, the part of the valley enclosed by them becomes discontinuous. Radial ridges may rise so high as to form vertical foliæ, with calicinal areas on both sides of the same, the septo-costæ becoming continuous over the sharp edge of a folia. Such vertical foliæ vary in length: in some coralla they are short, branching, and crowded. Secondary horizontal foliæ may also arise, with calicinal areas restricted to the upper surface.

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[*] **54**, 2.

[†] **54**, 1.

[‡] This feature has been noted in the tables of specimens under *C. dædalea* (Ell. & Sol.) and *C. lamellina* (Ehrbg.) 1928, pp. 34, 35, 44, & 45.

[§] See **65**, 1 & **66**, 3.

[||] **11**, 5, 6; **12**, 4, 6; **50**, 1.

[¶] 1924, **3**, 8.

[**] **64**, 5; 1924, **3**, 9; **8**, 6: Bedot, **23**, 111, 112, 114.

In *Merulina*[*] the radial mode of growth is evident. Valleys, which are, as in previous genera, restricted to the upper calicinal surface, undergo continued branching, these diverging towards the periphery, thereby giving the appearance of fan-growth. Hillocks often rise from the explanate basal folia, sometimes branching, each usually terminating in an oblique ridge with valleys on both sides[†]; secondary transverse partitions appear, tending to divide the valleys into corallites, but never rising to the level of the free margins of collines. The non-calicinal surface, which is usually somewhat concave, exhibits the radial mode of growth and has a somewhat central short peduncle of attachment. The primary basal folia may give rise to secondary horizontal foliæ.

By the breaking up of the radial ridges or collines of *Merulina* the monticular condition of *Hydnophora* is reached. In early growth stages the corallum consists of a basal folia, with the upper calicinal surface somewhat convex and the lower non-calicinal surface concave. In later stages hillocks usually rise from the calicinal surface and may secondarily branch and anastomose. The radial mode of growth is evident in the elongated monticules of *H. contignatio* (Forsk.)[‡] and *H. tenella* Quelch[§], and where monticules radiate towards the edge of the corallum as in *H. exesa* (Pallas)[||]. In *H. microconos* (Lamk.)[¶] and *H. grandis* Gard.[**] the monticules are usually so arranged that, if they united, they would form radial collines diverging towards the periphery. This arrangement can also be seen in *H. rigida* (Dana)[††], in which monticules, although conical, are arranged in rows and tend to approximate at their bases. In *Scapophyllia*, in which the corallum rises into more or less cylindrical columns of varying heights, valleys, although sinuous over the greater part of the surface, become radially straight at the periphery of the corallum [*].

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[*] **13**, 1–8 ; **59**, 3, 4 ; **67**, 3 : 1924, **3**, 7.

[†] Branching of hillocks is a conspicuous feature of *Merulina laxa* Dana, branches often coalescing (1924, **4**, 5, 6).

[‡] **15**, 3 ; **17**, 7–9 ; **18**, 1–3, 6 ; **46**, 2.

[§] **14**, 1, 6 ; **49**, 6.

[||] **14**, 5 ; **15**, 1, 2 ; **16**, 3, 4 ; **17**, 3 : 1924, **5**, 6 : Bedot, **25**, 123–129.

[¶] **49**, 5.

[**] **47**, 3.

[††] In *H. rigida* the corallum consists of branches often coalescing. **18**, 4 ; **49**, 8.

In the Atlantic genera the mode of growth of *Protomussa* is similar to that of *Caulastræa*, the corallites at the summits of branches. In *P. harttii* (Verrill) [†] peritheca may be absent or present. In *P. braziliensis* (Verrill) the corallum has become massive, as the branches are united up to their summits by peritheca. In *Eusmilia* radially bifurcating branches with distinct walls diverge upwards and outwards from a narrow base, and bear corallites and short valleys on their summits. Thus the growth-form of the single recent species of *Eusmilia*, *E. fastigiata* (Pallas) [‡], resembles that of *Euphyllia glabrescens* (Cham. & Eys.). Sufficient evidence is not available for determining the mode of growth of *Dichocœnia*, especially as the valleys are very short, but it is unlikely that the genus will differ from other astræids. In *Pectinia* the valley is continuous as in *P. brasiliensis* Ed. & H. [§], and shows a bilateral disposition consisting of axial and continuous radial rows of calicinal areas, or discontinuous as in *P. mæandrites* (Linn.), in which the radial mode of growth is only noticeable in a comparatively early stage [||]. In *Dendrogyra* [¶], in which the corallum rises into more or less cylindrical branches of varying height, the mode of growth is similar to that of *Scapophyllia*, valleys being sinuous in the central region but ending radially at the periphery of the corallum.

The growth-facies of *Mussa* is identical with that of *Eusmilia*. In *Mycetophyllia* the valley is invariably continuous and consists of a primary calicinal area in the centre and radial lobes of subsidiary calicinal areas that bifurcate as they pass from the centre towards the periphery. Radial ridges or collines are usually formed between the calicinal lobes. This mode of growth is reflected on the non-calicinal surface [**]. Each radial lobe usually contains more than one row of calicinal areas, since (1) radial ridges may not be formed between adjacent lobes, or (2) additional row or rows of calicinal areas may appear in a lobe that originally contained a single calicinal row, or (3) radial ridges may break up into monticules of varying length. In a young stage * six primary lobes are distinctly seen, one of which seems to have bifurcated; the primary calicinal area is situated in the centre, although the corallum is already somewhat elongated, but radial ridges are not seen between neighbouring lobes. In later stages with larger coralla † somewhat elongated radial ridges are seen between adjacent lobes. In final growth stages ‡ more than one row of calicinal areas occur between adjacent collines.

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[*] **51**, 2.
[†] **44**, 8 ; **62**, 13 : Verrill, **22**, 1, 2 ; **23**, 1, 2.
[‡] **47**, 4 ; **57**, 7 ; **62**, 17.
[§] **42**, 1–4 ; **62**, 16 : Verrill, **34**, 1.
[||] **64**, 8.
[¶] **49**, 3 ; **51**, 1.
[**] **61**, 5.

The mode of growth of *Isophyllia* is similar to that of *Symphyllia radians* Ed. & H. and *Mycetophyllia lamarckiana* Ed. & H., the valley being continuous in the young condition §. As growth proceeds the valley becomes discontinuous, due to (1) and (2) as under *Mycetophyllia* ||. As in the latter genus, the radial disposition of calicinal areas is well marked on the non-calicinal surface. In *Isophyllia multiflora* Verrill ¶ valleys are shorter and narrower than in *I. sinuosa* (Ell. & Sol.). In *Isophyllastrea* radial ridges are at first formed. The valley lobes between the ridges subsequently become divided by transverse partitions.

In *Mæandrina* valleys are sinuous in the central part of the corallum, but become straight at the edge as in *M. cerebrum* (Ell. & Sol.) **, or subsequently undergo terminal forking as in *M. clivosa* (Ell. & Sol.) †† and *M. labyrinthiformis* (Linn.) ‡‡. Sometimes comparatively straight valleys pass across the entire calicinal surface from edge to edge. In *Manicina* the radial disposition of lobes is noticeable when the corallum is circular §§.

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* **23**, 6.

† **54**, 4, 5.

‡ **33**, 2, 3.

§ **23**, 3, 4; **35**, 1–13; **36**, 1–7; **38**, 1–6; **55**, 1–9; **57**, 4*a*: Verrill, **16**, 1, 2; **17**, 1–7; **18**, 1, 2; **19**, 1–6.

|| **37**, 1, 2.

¶ Verrill, **20**, 1; **25**, 1; **35**, 1, 2.

** **9**, 4; **34**, 2.

†† **49**, 7: Verrill, **14**, 2.

‡‡ **12**, 2; **55**, 17; **57**, 9.

§§ **62**, 10, 14; **69**, 5.

While the corallum elongates with growth as in *M. areolata* (Linn.), a bilateral arrangement of lobes takes the place of the radial as in *Trachyphyllia geoffroyi* (Audouin) and *Pectinia brasiliensis* Ed. & H. Bifurcation of lateral lobes may be continued till a sinuous valley is produced [*]. In *M. gyrosa* (Ell. & Sol.), in which colonies become massive and valleys sinuous, the radial mode of growth is only recognizable in small colonies representing early growth-stages [†]. In *Colpophyllia* the radial mode of growth is evident in young coralla of both *C. amaranthus* (Müller) [‡] and *C. natans* (Müller) [§]. With growth the valley becomes sinuous and sometimes discontinuous, but radiates towards the edge, with or without terminal forking [‖].

It appears to be probable that in recent colonial astræids possessing distinct corallites [¶] the mode of growth is radially diverging from the centre, but the massive nature of the coralla obscures the direction of growth of single corallites [**]. Vertical sections of coralla, however, reveal the growth facies [††]. When corallites project above the surface of the corallum, as in *Galaxea fascicularis* (Linn.) [‡‡], *G. musicalis* (Linn.) [§§], and *Echinopora gemmacea* (Lamk.) [‖‖], the radial mode of growth becomes apparent.

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[*] **20**, 1–10; **21**, 1–9; **53**, 1–4; **55**, 10–16; **64**, 6; **68**, 3, 4; **69**, 4.

[†] **25**, 3; **56**, 1.

[‡] **24**, 4; **63**, 9. In a specimen probably belonging to *C. amaranthus*, in the Turin Museum, lobes radiate from the centre towards the periphery (1928, p. 109).

[§] **61**, 2.

[‖] **67**, 2.

[¶] Viz., *Cyphastrea, Echinopora, Galaxea, Leptastrea,* and *Diploastrea* with directive couples of mesenteries, and *Favia* and *Goniastrea* without such couples.

[**] Stephenson's account and figures of the growth of certain colonies of *Favia* do not indicate the direction of growth ('Great Barrier Reef Expedition, Scientific Reports,' vol. iii. no. 7, pp. 191–194, 1933).

[††] 1914, **34**, 1–9.

[‡‡] 1914, **16**, 4.

[§§] 1914, **16**, 2.

[‖‖] 1914, **15**, 5, 6.

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XVI.—*Entomological Expedition to Abyssinia,* 1926–27 : *Diptera-Brachycera,* Tabanidæ, Asilidæ, Bombyliidæ.

By H. Oldroyd, M.A., British Museum (Natural History).

This paper deals with the families Tabanidæ, Asilidæ, and Bombyliidæ from a collection made in Abyssinia in 1926 by Dr. Hugh Scott and Mr. J. Omer-Cooper. Fourteen species and one variety are represented, of which three species and one variety are described as new. An interesting capture is the Palæarctic Bombyliid, *Villa* (*Hemipenthes*) *velutina* Meigen, a species common in the Mediterranean but not, I think, previously found in the Ethiopian Region.

I am indebted to Dr. F. W. Edwards, Dr. B. M. Hobby and Dr. Hugh Scott for helpful criticism of the manuscript of this paper. All the material mentioned therein is deposited in the British Museum.

TABANIDÆ.

Only seven horse-flies were taken, representing three species. One species is new, a *Chrysozona* remarkable for its *Tabanus*-like appearance, and for its hairy eyes.

Chrysops.

Chrysops Meigen, Nouv. Class. p. 23, 1800 (no species).
Chrysops Meigen, Illig. Mag. ii. p. 267, 1803. (Type : *Tabanus cæcutiens* Linn., by monotypy.)

Chrysops streptobalia Speiser.

Chrysops streptobalia Speiser, Zool. Anz. xli. (3), p. 141, 1912.

Loc. Abyssinia : between Jem-Jem and Addis Ababa, 7000–8000 feet, 11–14. x. 1926, 1 ♀ (*Scott*).

This species was described from Asmara, Eritrea, and there is one specimen in the British Museum from Central Abyssinia, L. Tana, 13. v. 1915 (*O. Kovacs*). It is closely related to *C. obliquefasciata* Macquart from the Cape.

TABANUS.

Tabanus Linnæus, Syst. Nat. ed x. p. 601, 1758. (Type: *T. bovinus* Linn., by designation of Latreille, Consid. Gén. p. 443, 1810.)

Tabanus (*Ochrops*) *fuscipes* Ricardo.

Tabanus fuscipes Ricardo, Ann. & Mag. Nat. Hist. viii. (1), p. 332, 1908.

Loc. Abyssinia: in marsh, north-west shore of Lake Zwai, ca. 5500 feet, 3. xi. 1926, 1 ♀ (*Scott*).

A species mainly recorded from Central Africa, though the British Museum series extends from Southern Rhodesia to Northern Nigeria. The closely allied *T. ditæniatus* Macquart has a much wider distribution, and is recorded throughout the Ethiopian and Oriental Regions, though Bequaert (1930. Reps. Harvard Exped. Nigeria and Belgian Congo, xxxvi. p. 918) suggests that several closely-allied species have been confused, and that "perhaps *T. ditæniatus* is strictly South- and East-African."

CHRYSOZONA.

Chrysozona Meigen, Nouv. Class. p. 23, 1800 (no species).
Hæmatopota Meigen, Illig. Mag. ii. p. 267, 1803. (Type: *Tabanus pluvialis* Linn., by monotypy.)

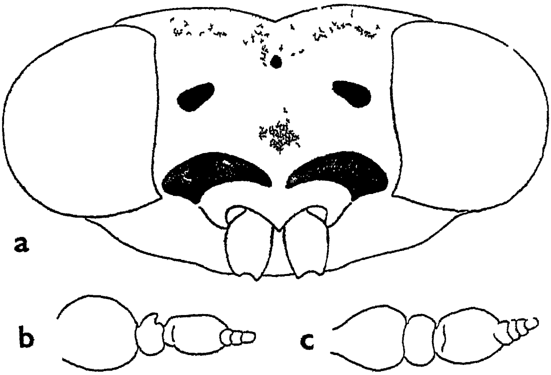
Chrysozona lasiops, sp. n. (Fig. 1.)

A squat, *Tabanus*-like species, somewhat resembling *C. hirta* Ricardo, but remarkable for its densely hairy eyes.

♀. *Head*: eyes with a dense and rather long dark brown pile. Frons (fig. 1 *a*) about one-and-one-third as wide as the greatest width of one eye, and about three-quarters as long as wide. Frontal callus shining black-brown, narrow (one-fifth height of frons), not meeting eyes at each end, and divided in the middle into two somewhat crescent-shaped halves. Tomentum of frons yellow-brown, rather darker in middle, with three black tomentose spots, the median one being quite small; at vertex a pair of dark brown triangles. Cheeks with yellow tomentum. Palpi pale yellow, proboscis brown.

Whole head very hairy, long hairs being brown on frons and upper parts of cheeks, yellow elsewhere Antennæ (fig 1 *c*) short, about as long as diameter of one eye in profile; first segment short, rather bulbous, second annular, both yellow with black hairs, third segment reddish-yellow, a little darker towards tip, basal portion laterally flattened, disciform. *Thorax*: mesonotum dark brown in middle, broadly light grey laterally, with six black stripes; paired median stripes which hardly extend backwards behind the suture, a pair of lateral stripes each broken into two parts by the suture, and a very short stripe on each side just above base of wing. Scutellum dark brown, grey at extreme angles. Thorax dorsally with long brown hairs, intermingled with short and sparse yellow ones. Pleura yellowish-grey, with the long hairs brown on mesopleuron, yellow elsewhere Halteres yellow, with brownish knobs. *Abdomen*: tergites dark brown, grey at extreme sides, and with the usual lateral grey spots fused into a pair of parallel-sided, very sharply-defined, light grey stripes. Venter uniformly brownish-yellow. Hairs black on tergites, except on the stripes, where they are yellow; laterally a fringe of long yellow hairs; ventrally, hairs yellow. *Legs*: yellow,

Fig 1



Chrysozona lasiops, sp. n

(*a*) Head from front (hairs and pubescence of eyes omitted); (*b*) antenna of male; (*c*) antenna of female.

coxæ and distal segments of tarsi a little greyish. Tibiæ practically uniformly yellow, but with slight traces of two paler rings on hind pair, chiefly indicated by distribution of black and yellow hairs. Other tibiæ show no traces of rings. Femora with the long hairs mainly black on fore-legs, and mainly yellow on hind pair. *Wings*: very faintly greyish, with a pattern of rosettes of the usual type, but hardly to be seen except against a dark background. *Length of body*, 9 mm.; *of wing*, 7·5 mm.

♂. Similar to female, except in the following respects:—First and second antennal segments grey-brown, third bright orange; dark thoracic stripes expanded and fused behind suture, so that mesonotum is mainly black-brown with light grey side-margins and a narrow grey median stripe, and a pair of wider lateral stripes which extend backwards only a little way behind suture; legs brownish.

Loc. Abyssinia: cultivated country near Addis Ababa, ca. 8000 feet, 18–19. ix. 1926, 1 ♀ (type) (*Scott*); Addis Alam, ca. 8000 feet, 19. ix. 1926, 1 ♂, 1 ♀; between Jem-Jem Forest and Wouramboulchi, 8000–9000 feet, x. 1926, 1 ♀; from the Serpent Lake at Wouramboulchi, ca. 9000 feet, 5. x. 1926, 1 ♀ (all these paratypes collected by *Omer-Cooper*).

ASILIDÆ.

BACTRIA.

Bactria Meigen, Syst. Beschr. Zweifl. Ins. ii. pp. 307–8, 1820. (Type: *Asilus pictus* Meigen, monotypic as *Bactria rufipes* Meigen.)

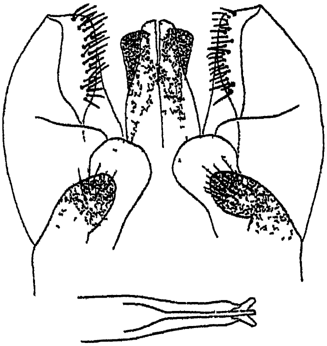
Promachus Loew, Linn. Entom. iii. p. 390, 1848. (Type: *Asilus maculatus* Fabr., by designation of Coquillet, Proc. U.S. Nat. Mus. xxxvii. p. 595, 1910.)

Bactria scotti, sp. n. (Fig. 2.)

A smallish black species, with a thick white anal tuft in the male, legs reddish-brown, except for the femora, which are black, reddish ventrally. Near *B. rectangularis* Loew and *B. rueppelli* Loew, but distinguished by the closed first posterior cell, a character rare in this genus. Closest to *B. argyropus* Bezzi, described from Eritrea, which also possesses a closed first posterior cell, but has the legs more extensively black.

♂. *Head*: black, with thick yellowish-white tomentum. Moustache, and two rows of hairs extending from it up to bases of antennæ, yellowish, hairs on side of frons and on ocellar tubercule black. Upper occipital bristles mainly black, lower ones on each side yellowish ; beard fine and yellowish. First and third antennal segments black, second orange ; first and second segments with yellowish hairs below, black hairs above ; third segment about equal in length to first two together ; arista about same length as third segment, with a very slight swelling just before tip. Proboscis and palpi black, with yellow hairs, and a few long black hairs at tips of palpi. *Thorax* : black, except humeri and postalar callosities, which are orange. Pronotum with black and yellow bristles, and white or yellowish hairs. Bristles and hairs of mesonotum entirely black, excepting one or two fine hairs at sides of scutellum. Pleural hairs white, excepting metapleural fringe, which is yellow with one or two black bristles. Mesopleuron with 15–20 stiff black bristles along upper margin. Halteres pale yellow. *Abdomen* : tergites black, broadly orange at sides, with white tomentum at sides and along hind margins. Sternites orange. Hairs and bristles entirely black, except on sides and venter of first segment. Terminalia (fig. 2) orange, with a thick tuft of white bristles dorsally, entirely covering the upper forceps when seen from above. Bristles white except those of the eighth sternite and a few at sides of upper forceps. Eighth sternite not produced,

Fig. 2.



Bactria scotti, sp. n.
Male terminalia (partly dissected and mounted flat in balsam)

margin somewhat concave, with two tufts of black bristles projecting backwards; ædeagus bluntly trifid. *Legs*: coxæ black or blackish, with white hairs; stout bristles mostly white or yellowish, but one or two are black. Femora mainly black, reddish posteroventrally. Anterior face of fore and middle tibiæ more or less blackish, tibiæ and tarsi otherwise entirely orange. Bristles of femora all black, except an anterior bristle near apex of each hind femur; bristles of tibiæ and tarsi mixed, most of those of fore and middle pairs white, most of those of hind pair black. *Wings*: greyish-hyaline, with a lenticular patch of infuscation in cell R_3, but none in any other cell. Costal margin does not extend beyond apex of wing. First posterior cell closed and stalked. Veins becoming weaker towards hind margin of wing, though still quite visible. *Length of body*, 14 mm.; *of wing*, 11 mm.

Loc. Abyssinia: Mt. Chillálo, moorland, ca. 10,000 feet, 21. xi. 1926, 2 ♂, type and paratype (*Scott*).

In the second specimen the lower hairs at the sides of the frons and practically all the occipital bristles are yellow, and there is no infuscation in cell R_3.

I think it very probable that this will prove to be no more than a variety or local race of *B. argyropus* Bezzi. Comparison of the two descriptions, however, will show numerous differences in details of coloration, and until the terminalia of the two can be compared it is better to regard them as distinct.

Bactria (*Trypanoides*) *binucleatus* Bezzi.

Promachus binucleatus Bezzi, Ann. Soc. ent. Belg. lii. p. 378, 1908.

Loc. Abyssinia: Wambar Mariam, at foot of Mt. Zukwala, ca. 7000 feet, from dry grass, 28. x. 1926, 1 ♂; dry grassy country on north-west shore of Lake Zwai, ca. 5500 feet, 3. xi. 1926, 1 ♀ (both *Scott*).

The female of this species was described from "N. O. Africa, Van Abala (*V. Erlanger*)" *, and Speiser (in Sjöstedt's Kilimandjaro-Meru Expedition (10) iv. p. 98, 1910) first recorded the male from the "Obstgartensteppe" of Kilimandjaro, remarking on the conspicuous triangular prolongation of the eighth sternite in the male, which forms a useful distinguishing mark. Bezzi (Ann. Mus. zool. Univ. Napoli, iv. p. 5, 1914) recorded it from Ruanda, and Miss Ricardo (Ann. & Mag. Nat. Hist. (9) v. p. 209, 1920) listed a long series in the British Museum from various localities in Kenya and Uganda.

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* Van Abala is probably a locality in Southern Abyssinia visited by Erlanger on one of his journeys. Speiser (*loc. cit.*) refers to it as being "in den Gallalandern."

NEOLOPHONOTUS.

Lophonotus Macquart, Mém. Soc. Sci. Agric. Lille, 1838 (3), p. 241, 1838; id., Dipt. Exot. i. (2), p. 125, 1838, nec Stephens, 1829. (Type : *Asilus chalcogaster* Wiedemann, by designation of Coquillet, Proc. U.S. Nat. Mus. xxxvii. p. 562, 1910.)

Neolophonotus Engel, Bull. Soc. Roy. Ent. Egypte, 1924, p. 347 (new name).

Neolophonotus (*Lophopeltis*) *molitor* Wied.

Asilus molitor Wiedemann, Ausser. Zweifl. Ins. i. p. 450, 1828.

Loc. Abyssinia : dry grassy country, north-west shore of Lake Zwai, ca. 5500 feet, 3. xi. 1926, 1 ♂, 2 ♀ (*Scott*).

This species and the closely related *N. spiniventris* Loew were described from the Cape, and have both since been recorded from Egypt, but not, I believe, from any intermediate locality.

MACHIMUS.

Machimus Loew, Linn. Ent. iv. p. 1, 1849. (Type : *Asilus chrysitis* Meigen, by designation of Coquillet, Proc. U.S. Nat. Mus. xxxvii. p. 564, 1910.)

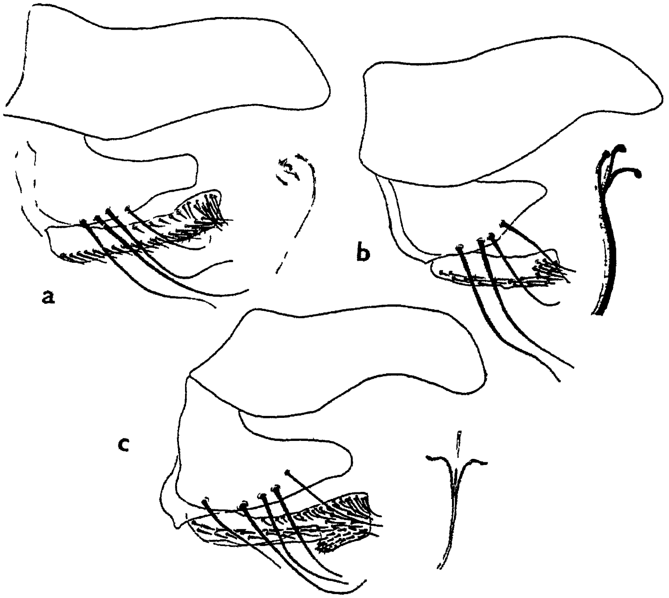
Tolmerus Loew, Linn. Ent. iv. p. 94, 1849. (Type : *Asilus pyragra* Zeller, by designation of Coquillet, Proc. U.S. Nat. Mus. xxxvii. p. 615, 1910.)

Machimus (*Tolmerus*) *comans*, sp. n. (Fig. 3 *a*.)

A medium-sized, grey-brown or yellowish-brown species distinguished by its very bristly thorax and entirely black legs. It resembles *T. pammelas* Speiser from Meru, and, more nearly, *T. atripes* Loew from central and southern Europe, but may be separated from both these species by the fact that the dorsocentrals are well developed on the prescutum, as far forward as the humeri.

♂. *Head* : with thick yellowish tomentum. Rather more than upper half of moustache black, lower part yellowish. Hairs at sides of frons and on ocelli black. Upper occipital bristles black, lower bristles and all hairs yellowish. Antennæ black with black hairs, especially long and stout below first segment ; first and second segments equal in length, third segment and arista each nearly as long as first two together. Proboscis and palpi black, former with yellowish, latter with black hairs. *Thorax*: blackish-brown with golden tomentum. A wide longitudinal stripe, indistinctly divided, ends just before scutellum in a short black stripe; on each side of this a broad blackish-brown lateral stripe, behind which is a small triangular black spot. Pronotum and scutellum with uniformly golden tomentum. Pronotal hairs and bristles all yellow. Mesonotum very bristly, clothing bristles long and stiff, especially in front, and between dorsocentrals; 4–6 strong presutural dorsocentrals, extending forward to hind margin of humeri, and merging into a patch of stout clothing bristles there; a cluster of 4–5 notopleurals, 3 supra-alars, 2 post-alars, 4–6 marginal scutellars. All bristles black, except isolated scutellars and lateral bristles, which are yellowish. Pleura with uniformly golden tomentum, hairs and bristles yellow, except a few weak black bristles on upper margin of

Fig. 3.



Male terminalia (dissected and mounted flat in balsam; bristles schematic).

(a) *Machimus* (*Tolmerus*) *comans*, sp. n.; (b) *M.* (*T.*) ? sp.; (c) *M.* (*T.*) *comans* var. *griseus*, var. n.

mesopleuron. Halteres orange. *Abdomen*: black, with golden tomentum, especially thick at sides and along hind margins, and with yellow hairs and bristles; a row of black hairs along hind margin of first segment, and on each of the following segments a median triangular spot shining oily black, with black hairs, the spots increasing in size posteriorly. Venter similar, but without bare patches. Terminalia (fig. 3 *a*) shining black, with yellow hairs and bristles; a fringe of stout bristles on the lower forceps. Eighth sternite not produced, though slightly convex in outline, with a fringe of stout bristles which may be black or yellow. Ædeagus long, slender, trifid. *Legs*: entirely shining oily black, with no trace of reddish colour even at bases of tibiæ. Coxæ black with golden tomentum and yellow hairs and bristles. All femora with bristles below, those of fore-femora rather slender, a row of black ones running into a cluster of yellow ones at base. Black bristles in front of tibiæ, on tarsi, and dorsally on fore femora: most of other bristles yellow. Clothing hairs mostly yellow on middle and hind legs, mostly black on fore legs, except posteriorly on tibiæ. *Wings*: costal border distinctly dilated, and wing-membrane ribbed in marginal cell. A greyish infuscation in every cell, clearer areas along veins and at bases of humeral and first basal cells. *Length of body* 13 mm.; *of wing*, 10 mm.

♀. Closely similar, except for undilated wing. Ovipositor rather longer than two preceding segments.

Loc. Abyssinia: Mt. Chillálo, Digalla, ca. 9500 feet, 26. xi. 1926 (type ♂ and 4 ♂ & 5 ♀ paratypes) (*Scott*).

There is a certain amount of variation on this species, chiefly in the coloration of bristles. The number of yellow bristles on the legs is variable, and the tuft on the eighth sternite may be almost entirely yellow, or almost entirely black.

Machimus (*Tolmerus*) *comans*, var. *griscus*, var. n.

(Fig. 3 *c*.)

Two males, differing from the above in the generally greyer appearance, the tomentum of the thorax being cold grey in colour; in the much less dilated wing; and in the terminalia (fig. 3 c), especially the wider and more bristly tip of the claspers (styles of IX).

Loc. Abyssinia: Mt. Zukwala, ca. 9000 feet, 21–25. x. 1926, 1 ♂ (type); same locality, in crater, 26. x. 1926. 1 ♂ (both *Scott*).

One male from Mt. Chillálo, forest, ca. 9000 feet, 14. xi. 1926 (*Scott*), seems to me to be indistinguishable from *T. comans* in anything but the male terminalia, which, however, differ sharply (fig. 3 *b*). Two females from the same locality may be provisionally associated with it, but in the absence of further male specimens I must leave this form without a name.

BOMBYLIIDÆ.

BOMBYLIUS.

Bombylius Linnæus, Syst. Nat. ed. x. p. 606, 1758. (Type: *B. major* Linn., by designation of Latreille, Consid. Gén. p. 443, 1810.)

Bombylius neithokris Jaenn.

Bombylius neithokris Jænnicke, Abhandl. Senckenb. Naturf. Ges. vi. p. 347, 1867.

Loc. Abyssinia: Jem-Jem Forest, 8000–9000 feet, 21–29. xi. 1926, 1 ♀ (*Scott*).

An Abyssinian species, which has also been recorded from Eritrea, and, doubtfully, from Kenya.

Bombylius femoralis Bezzi.

Bombylius femoralis Bezzi, Bomb. Ethiop. Reg., p. 52, 1924.

Loc. Abyssinia: Jem-Jem Forest, ca. 8000 feet, 5–10. x. 1926, 1 ♂ (*Scott*).

Described from Abyssinia, this species differs from the preceding in the black notopleural hairs, the black hairs on the basal antennal segments, and the darkened bases of the femora. It also lacks the appendix to R_4 which is usually found in *B. neithokris*, and which is present in the specimen of that species recorded above. Bezzi suggested that *B. femoralis* and one or two closely-related species were probably varieties of *B. neithokris*.

LOMATIA.

Stygia Meigen, Syst. Beschr. Zweifl. Ins. ii. p. 137, 1820; nec Latreille, 1804.

Lomatia Meigen, *op. cit.*, iii. 1822 (Vorwort), new name. (Type: *Anthrax belzebul* Fabr., by designation of Westwood, Introd. Mod. Class. Ins. ii. Syn. Brit. Gen. p. 131, 1840.)

Engel (in Lindner, Flieg. Pal. Reg., Lief. xxv. p. 361, 1935) gives *Bibio sabæa* Fabr. as genotype, but quotes no authority for this. It is true that this species was designated by Rondani (Dipt. Ital. Prodr. i. p. 163, 1856), but Westwood's selection has priority.

Lomatia inornata Loew.

Lomatia inornata Loew, Neue Beiträge Kenntn. Dipt. ii. p. 2, 1854.

Loc. Abyssinia: Jem-Jem Forest, 8000–9000 feet, in meadow and hovering over path, 21–29. ix. 1926, 3 ♂, 9 ♀ (*Scott*).

Described from Nubia, and recorded by Bezzi from Southern Abyssinia and, doubtfully, from N. Nyasa.

LITORRHYNCHUS.

Litorhynchus Macquart, Dipt. Exot. ii. (1), p. 78, 1840. (Type: *Bibio lar* Fabr., by present designation.)

In introducing this name Macquart wrote: "L'*Anthrax lar* Fab., et quelques autres, présentent la réunion de ces caractères, qui nous paraissent former un type générique, voisin des *Mulions* . . . ." Under Art. 30 I (*g*) of the International Rules of Zoological Nomenclature this does not constitute a selection of type, although the author's intention is evident. The type of *B. lar*, an Indian species, was in the Banks collection, and is now in the British Museum. Bezzi (1924, p. 212) states that "the genotype of *Litorrhynchus* is somewhat ambiguous in character," but does not indicate what species he regards as genotype, and I do not know of any previous type-designation for this genus.

Litorrhynchus suspensus Bezzi.

Litorrhynchus suspensus Bezzi, Bomb. Ethiop. Reg., p. 226, 1924.

Loc. Abyssinia: Jem-Jem Forest, ca. 8000 feet, 5–10. x. 1926, 1 ♀ (*Scott*).

This species was hitherto represented in the British Museum only by the type, which was taken in Southern Abyssinia in November, 1911 (*R. J. Stordy*). It is very closely related to *L. erythræa* Bezzi and *L. allothyris* Bezzi (Speiser *in litt.*), which are found in East Africa as far south as Nyasaland.

VILLA.

Villa Lioy, Atti. Istit. Veneto ix. (3), p. 732, 1864. (Type: *Anthrax abbadon* Fabr. (as *concinnus* Meig.), by designation of Coquillet Proc. U.S. Nat. Mus. xxxvii. p. 619, 1910.)

Hemipenthes Loew, Berl. Ent. Zeitschr. xiii. p. 28, 1869. (Type: *Musca morio* Linn., by monotypy, *seminiger* Loew, the second species, being a synonym.)

Villa (*Villa*) *paniscoides* Bezzi.

Villa paniscoides Bezzi, Trans. Ent. Soc. Lond. 1911, p. 624, 1912.

Loc. Abyssinia: Jem-Jem Forest, 8000–9000 feet, 21–29. ix. 1926, 1 ♀; same locality, ca. 8000 feet, 5–10. x. 1926, 1 ♀ (*Scott*).

One of several closely-related clear-winged species, which are found from Nyasaland northwards. It has been recorded from Abyssinia by Bezzi (1924).

Villa (*Hemipenthes*) *velutina* Meigen.

Anthrax velutinus Meigen, Syst. Beschr. Zweifl. Ins. ii. p. 160, 1820.

Loc. Abyssinia: Jem-Jem Forest, 8000–9000 feet, 21–29. ix. 1926, 1 ♂, hovering over open path (*Scott*).

This Palæarctic species is common in the Mediterranean sub-region, and is found in Asia down to Persia and Baluchistan, but has not, I believe been previously recorded from the Ethiopian Region.

XVII.—*Beiträge zur Kenntnis der Conopiden.*—VI.

Von O. Kröber, Hamburg.

(Concluded from p. 82.)

V. DIE CONOPIDEN DER ORIENTALISCHEN FAUNA.

Die nun noch zu behandelnden orientalischen Conopiden bieten einstweilen noch die grössten Schwierigkeiten, nicht sowohl, weil die palaearktische und australische Fauna teilweise ihre Formen hineinsendet, sondern weil die Arten in den unendlich heterogenen Gebieten des Riesenlandes offenbar stark zur Bildung lokaler Rassen neigen. Ganz besonders macht sich das bei den grossen, artenreichen Gattungen *Conops* und namentlich *Physocephala* bemerkbar. Ich habe deshalb auf die Beschreibung der meisten Einzelstücke verzichtet, da nach den bisher benutzten Merkmalen eine sichere Bestimmung in vielen Fällen kaum möglich sein wird. *Physocephala*

neigt ja in allen Zonen stark zur Variabilität, und viele der beschriebenen Arten müssen wohl als Beschreibung von Einzeltieren bewertet werden Wo z. B. Brunetti mehrere Exemplare einer neuen Art vorlagen, da liest man aus jeder Beschreibung heraus, dass die Tiere unter sich noch wieder stark abweichen, und dass er sie auf Grund dieser Merkmale an ganz verschiedenen Punkten seiner Tabellen einordnen müsste! Ich werde meine Beobachtungen bei dieser Gattung mitteilen!

Die Gattung *Conops* wird bestimmt noch in eine ganze Anzahl von Untergattungen bezw. Gattungen aufgespalten werden, sobald umfangreicheres Material vorliegt. Habituell schon enthält sie die verschiedensten Typen. Dazu kommt, wie auch bei den Australiern, das Vorhandensein eines Ozellenhöckers mit Ozellen oder das Vorhandensein einer kallosen Schwiele, wodurch eigentlich analog *Physoconops* diese Vertreter aus der Gattung herausgenommen werden müssten. Desgleichen ändert die Gestalt der 1. Hinterrandzelle. Ich verzichte auf eine Aufspaltung, da weitere generisch wertvolle Merkmale z. Z. noch nicht auffindbar sind.

Bei der Bestimmung orientalischen Materials muss auf jeden Fall die benachbarte palaearktische und australische Fauna herangezogen werden, da Arten von Japan bereits in Südchina und Formosa, solche von Belutschistan bis Indien festgestellt wurden. 2 Arten treten auch in Afrika auf. Vom australischen Formenkreis treten bisher nur wenige auf das orientalische Gebiet über, wenn die Angaben überhaupt stimmen. Verschiedene Arten Walker's, de Meijere's, Coquillet's und Matsumura's habe ich nicht kennen gelernt; von manchen kann ich nicht einmal die Beschreibung erreichen. Deren Zugehörigkeit zu den jetzt bestehenden Gattungen muss also noch nachgeprüft werden. Das gilt auch von einigen meiner eignen Arten, bei deren Beschreibung ich auf die heutigen Merkmale nicht achtete, und die ich z. Z. nicht erlangen kann.

Diese Arbeit umfasst 15 Gattungen mit 126 Arten. Das bedeutet gegenüber meinem Catalog von 1917 einen Zuwachs von 9 Gattungen und 62 Arten. Von den mir bekannt gewordenen Formen der alten Autoren, die von unbekanntem Fundort beschrieben wurden, gehört keine in die orientalische Fauna.

Bestimmungstabelle der Gattungen.

1 Fühler mit Endgriffel .... 1. Unterfam. CONOPINÆ.
Fühler mit Rückenborste .... 2.

2. Untergesicht hoch gekielt, ohne Gruben. Rüssel sehr auffallend lang und dünn. Lippen sehr lang, fädlich, oft nach aussen umgerollt. Fühlerborste deutlich 3-teilig. Körper sehr zart und schlank. Weibchen mit lang vorstehender Legeröhre ...... 2. Unterfam. STYLOGASTERINÆ.
Nur eine Gattung: *Stylogaster* Macq.

Untergesicht nie gekielt, stets mit Gruben. Rüssel nie auffallend lang und dünn, oft kurz und in der Mundhöhle verborgen. Fühlerborste 2-gliedrig .... 3. Unterfam. MYOPINÆ.

MYOPINÆ.

1. Rüssel nur an der Basis gekniet .... *Zodion* Latr.
(Es liegt ein Exemplar einer neuen Gattung vor, leider ohne Abdomen!)

Rüssel an der Basis und in der Mitte gekniet .... 2.

2. Untergesicht stark verlängert und weit unter die Augen herabgehend; die Backen wenigstens doppelt so lang wie der Augendurchmesser .... 3.

Untergesicht mässig verlängert; die Backen höchstens so lang wie der Augendurchmesser, meistens viel kürzer ...... 4.

3. Hinterleib bedeutend kürzer als die Flügel, oben platt. Untergesicht vorgezogen. Fühlerborste dick, deutlich 2-gliedrig.... *Myopa* F.

Hinterleib lang, walzig, oben nicht abgeplattet. Kopf gleichmässig konvex. Fühlerborste schlank, sehr unklar gegliedert .... *Melanosoma* Rob.-Desv.

4. Fühler viel länger als ihr Abstand vom Scheitel, meistens kopflang. Kleine, grauschwarze oder schwarze Arten, mit nie ganz rotgelber Stirn. Hinterleib kurz, namentlich beim Weibchen. Kopf am Mundrand vorgezogen .... *Occemyia* Rob.-Desv.

Fühler viel kürzer als ihr Abstand vom Scheitel. Grosse, robuste, meist rostbraun gefärbte Arten mit ganz rotgelber Stirn. Hinterleib lang, schmal, weit umgebogen beim Weibchen .... *Sicus* Scop.

CONOPINÆ.

1. Untergesicht ohne Gruben .... *Tropidomyia* Will. (1 Art).
Untergesicht mit Gruben .... 2.

2. Fühler kaum kopflang, mit rundlichem Endglied. Kopf rundlich, aufgeblasen. Vertexkissen nimmt nur die Mitte des Scheitels ein .... 3.

Fühler mindestens kopflang, mit spatelförmigem Endglied.................. 4.

3. 3. Fuhlerglied deutlich langer als das 2. Art von 5 mm.	*Microbrachyceræa,* gen. nov. (1 Art).
2. und 3. Fühlerglied gleich lang. Statt der Punktaugen ein tiefes Grübchen im Ozellenhöcker. Stirn nicht breiter als ein Auge	*Neobrachyceræa* Szil. (2 Arten).
4. 3. Fuhlerglied stets das langste, ca. 1½ mal so lang wie das 1. und 2. zusammen......	*Pleurocerinella* Brun. (2 Arten).
3. Fühlerglied nie das längste	5.
5. 2. und 3. Abdominalsegment gleich lang und ziemlich gleich stark	6.
2. Abdominalsegment bedeutend länger als das 3.	7.
6. Analsegment quer zur Längsachse des Körpers gestellt	*Conops* L. (47 Arten).
Analsegment in die Längsachse des Körpers gelagert	*Macroconops* Krb. (1 Art).
7. Vertexkissen mit deutlichem Ozellenhöcker	*Physoconops* Szil. (2 Arten).
Vertexkissen ohne jede Spur vom Ozellen ..	8.
8. Kurze, gedrungene Arten mit grossem, flachem Kopf und mit lackartig glänzendem Einschnitt am Hinterrand des Auges	*Pseudophysocephala,* gen. nov. (1 Art).
Langgestreckte, meist schlanke Arten mit ±halbkugeligem Kopf, ohne Keilfleck am Augenhinterrand. Analsegment quer zur Längsachse des Körpers gestellt	*Physocephala* Schin. (41 Arten).

Bestimmungstabelle der Arten.

1. STYLOGASTER Macq.

1. f_3 nahe der Basis mit einer deutlichen schwarzen Haarbürste	*S. Bakeri* Bezzi.
f_3 ohne solche Haarbürste	*S. orientalis* Brun.

2. ZODION Latr.

Männchen.

1. Anus schwarz. Hinterleib mit schwarzen Borstenpunkten	*Z. cinereum* F.
Anus schwarz. Abdomen offenbar ohne Borstenpunkte. Thorax mit 2 schwarzen Striemen bis zum Schildchen und den Anfängen zweier andrer dazwischen. *f* an der Spitze unten zu ⅓ gelbbraun	*Z. grisescens* Brun.

Weibchen.

1. Anus rot	*Z. andersoni* Krb. (n. nov. pro *Z. intermedium* Krb.).
Anus schwarz	2.
2. Abdomen ohne Borstenpunkte. Theka schwarz. Fühler tiefschwarz. 2. und 3. Glied fast gleich lang. 1. Hinterrandzelle weit offen	*Z. grisescens* Brun.
Abdomen mit Borstenpunkten	3.
3. Theka an der Vorderseite rotgelb. Fühler teilweise gelbrot. 1. Hinterrandzelle meistens gestielt	*Z. cinereum* F.
Theka schwarz (?). 2. und 3. Fühlerglied unten rotgelb. 1. Hinterrandzelle schmal offen	*Z. montanus* Brun.

3. MYOPA F.

1. 1. Hinterrandzelle hyalin, mit grossem, ovalem, isoliert stehendem, braunem Fleck. Wangen schwarz gefleckt .... *M. picta* Pz.

1. Hinterrandzelle stets ohne solchen Fleck .... 2.

2. Am Mundrand jederseits ein schwarzer Fleck. Zwischen Auge und Fühlerwurzel ein schwärzliches oder bräunliches Querband. Backenbart sehr zart. Letzte Abdominalsegmente stets hell tomentiert mit tiefschwarzen, rundlichen, isolierten Flecken. Flügel vollkommen hyalin, keine Ader fleckig oder auffällig stark. Thorax schwarz .... 3.

Mundrand ohne schwarze Flecke .... 5.

3. Abdomen an der Basis ±gelbbraun. Fühler grösstenteils gelbbraun .... *M. variegata* Meig.

Abdomen ganz schwarz .... 4. [var. *asiatica* Krb.

4. Fühler schwarz, mindestens das 3. Glied . *M. variegata*

Fühler ganz rotgelb .... *M. nigriventris* Brun.

5. Backenbart stets vorhanden. Hintere Querader stets schwarz gesäumt. Körper vorherrschend hell rostbraun .... *M. testacea* L.

Backenbart fehlt vollkommen .... 6.

6. Thorax schwarz. Stirn schlicht rotbraun.. *M. dorsalis* F.

Thorax rotbraun, vorn mit dem Anfang einer kleinen schwarzen Doppelstrieme. Stirn mit schwarzer Querstrieme....... *M. curta* Krb.

(Hierher vielleicht *M. cincta* F., wenn das kein *Sicus* ist.)

4. MELANOSOMA Rob.-Desv.

1. *p* schwarz. Abdomen glänzend schwarz. Basalhälfte der Flügel auffallend intensiv rotgelb. Fühlerborste schwarz. 9 mm. *M. carbonaria* Krb.

p ganz oder grösstenteils rotgelb oder gelb. Abdomen teilweise rotgelb........... 2.

2. Flügel absolut hyalin. Behaarung des Thorax schwarz. Fühler rotgelb ...... *M. hyalipennis* Krb.

Flügel an der Basis gelblich. Behaarung des Thorax wollig gelbbraun. Fühler am Ende des 3. Gliedes bräunlich...... *M. bella* Krb.

5. OCCEMYIA Rob.-Desv.

Männchen.

1. 2. Fühlerglied deutlich länger als das 3. Hinterleib wenig glänzend, ziemlich gleichmässig mit weisslichem Toment bedeckt .... *O. atra* F.

2. Fühlerglied deutlich länger als das 3. Hinterleib stark glänzend. Toment bildet intensive Binden am 1.–4. Ring... *O. sauteri* Krb.

Weibchen.

1. 2. Fühlerglied deutlich länger als das 3. Theka dreieckig .... *O. atra* F.

2. und 3. Fühlerglied fast gleich lang. Theka löffelförmig oder kreisrund...... 2.

2. Theka kreisrund, so weit vorstehend wie die Hinterleibspitze. *p* schwarz bis hellgelb .... *O. pusilla* Meig.
Theka auffallend gross, tütenförmig, weiter vorstehend als die Hinterleibspitze .... *O. cænovalva* Krb.
(Hierher wohl *O. flavipes* Brun.
Unbekannt blieben mir *O. simillima* de Meij., *O. niitapensis* Mats. und *O. ogumæ* Mats.)

6. SICUS Scop.

Weibchen.

1. Theka so lang wie die Abdominalspitze. Fühlerborste kurz, griffelförmig, kaum halb so lang wie das 3. Fühlerglied .... *S. vaginalis* Krb.
Theka kurz. Fühlerborste länger als das 3. Glied .... *S. ferrugineus* L.

Männchen.

1. Abdomen dunkelrotbraun, aber oben grösstenteils schwarz. Scheitel dunkelrotbraun. 2. Hinterleibring breiter als lang .... *S. nigricans*, n. sp.
Abdomen durchaus dunkelrotbraun. Scheitel ganz gelb. 2. Hinterleibring länger als breit .... 2.
2. 2. Hinterleibring bedeutend länger als jeder andere .... *S. ferrugineus* L.
2. Ring fast so lang wie der 3. Abdomen sehr robust, breit. *f* ganz rotbraun.... *S. indicus* F.

7. TROPIDOMYIA Will.

1. Stirn mit sattelförmigem schwarzbraunem Fleck, der bis zum Scheitel reicht und neben den Fühlern breit herabsteigt, nur einen schmalen gelben Strich neben den Augen freilassend .... *T. frontosa*, n. sp.

8. MICROBRACHYCERÆA, gen. nov.

1. Hinterleib wie bei *Physocephala.* Kopf wie bei *Brachyceræa,* aber das 3. Fühlerglied deutlich länger als das 2. Gesichtsgruben ganz flach, desgleichen der Kiel. Man könnte fast sagen: Untergesicht flach gekielt, ohne Gruben .... *M. pendleburyi* Brun.

9. NEOBRACHYCERÆA Szil.

1. Kopf dunkel braungelb, glanzlos. Fühlerhöcker und Mittelpartie des Kieles schwärzlich .... *N. obscuripennis* Krb.
Stirn mit breiter schwarzer Längsstrieme vom Fühlerhöcker bis zum Scheitel. [var. *nigrita* Krb.
Gruben und Kiel einheitlich schwarz.... *N. obscuripennis*

10. PLEUROCERINELLA Brun.

1. 1. Hinterrandzelle ziemlich lang gestielt. 6. Abdomenalring lang, seitlich mit einer deutlichen Delle; 3. und 4. Tergit mit dem Anfang eines weissen Saumes.

t schwarz. Der ganze Körper glänzend blauviolett. 7 mm. .... *P. violacea* Krb.
1. Hinterrandzelle verhältnismässig kurz gestielt. 6. Tergit kurz, ohne seitliche Delle. 2.–4. Tergit mit silberweissem Saumfleck. *t*-basis ca. zu ⅓ hellgelb. Metatarsen gelbbraun. 8–9 mm. .... *P. dioctriæformis* Brun.

11. Macroconops Krb.

1. Grosse, einfarbig rostbraune Art; Analsegment 1¼ mal so lang wie das vorletzte Segment .... *M. helleri* Krb.

12. Conops L.

1. Hinterleib vorherrschend rotgelb. Fuhler hellrotgelb. Flügel gelb tingiert mit unscharf begrenztem Spitzenfleck ...... [Big.
Gruppe *nubeculosus*
2. Sammetmakeln der Stirn hellrotgelb .... Gruppe *rufomaculatus*
3. Ganz schwarze Arten mit stahlblauem oder violettem Schein. Kopf gross, rotgelb, blasig aufgetrieben............ [Krb.
[F.
Gruppe *erythrocephalus*
4. Ganz schwarze Arten, eventuell mit stahlblauer Abdominalspitze. Kopf normal, nicht blasig aufgetrieben. Schwarze Sammetmakeln am Augenrand .... [de Meij.
Gruppe *morosus*
5. Hinterleib schwarz mit rotgelben oder rotbraunen Flecken oder mit hellen Hinterrandsäumen. Fühler schwarz. Sammetmakeln schwarz .... Gruppe *pactyas* Walk.
6. Stirn ohne Sammetmakeln .... Gruppe *rubripes* Krb.

Gruppe nubeculosus.

Weibchen.

1. Sammetmakeln fehlen. Stirn mit schwarzer, senkrechter Strieme .... [(*intermedius* Brun.).
C. nigrofasciatus Krb.
Sammetmakeln vorhanden .... 2.
2. Makeln rotbraun .... *C. nubeculosus* var.
[*brunneomaculatus*, n. var.
Makeln tiefschwarz .... 3. [*indicus* Krb.
3. Thorax ohne jede Striemung .... *C. nubeculosus* var.
Thorax mit einer oder mit 3 event. zusammengeflossenen Striemen .... 4.
4. Thorax mit einer fleckenartigen Strieme oder dem Anfang einer solchen .... *C. nubeculosus* Big.
Thorax mit 3 Striemen .... 5.
5. Thorax mit 3 klaren Striemen. *t* weissschimmernd. Flügel sehr intensiv und fast vollständig tingiert .... *C. nubeculosus* var.
ornatus Big. (*bigoti* Brun., n. n.).
Thorax mit 3 zusammengeflossenen Striemen .... 6.
6. *f* schwarz gefleckt .... *C. flavonervosus*, n. sp.
f ganz rotgelb .... 7.
7. Tergite mit zartem weisslichem oder gelbem Toment an den Einschnitten. Thorax kaum mit Goldtoment .... *C. rufifrons* Dol.

Tergite ausserst breit und satt goldig bandiert. Thorax am ganzen Rand breit goldgelb eingefasst .... *C. bakeri* Krb.
(Hierher vielleicht *C. javanicus* Dol. (♂♀ ?).)

Mannchen.

1. Sammetmakeln fehlen. Stirn mit schwarzer senkrechter Strieme .... *C. nigrofasciatus* Krb. [(*intermedius* Brun.).
Sammetmakeln vorhanden, tiefschwarz .. 2.
2. Thorax ohne Striemung............... *C. nubeculosus* var. [*indicus* Krb.
Thorax mit 1 oder 3 eventuell zusammengeflossenen Striemen .... 3.
3. Thorax mit 1 fleckenartigen Strieme oder dem Anfang einer solchen .... *C. nubeculosus* Big.
Thorax mit 3 Striemen .... 4.
4. Thorax mit 3 klaren Striemen .... 5.
Thorax mit 3 zusammengeflossenen Striemen. *t* ganz rotgelb .... 6.
5. *t* weisstomentiert. Flugel sehr intensiv und ziemlich vollstandig tingiert ...... *C. nubeculosus* var. [*ornatus* Big.
t goldgelb tomentiert. Flugel wie gewöhnlich .... *C. nubeculosus* var. [*fulvicornis* Krb.
6. Tergite mit zartem weisslichem oder gelblichem Toment an den Einschnitten. Thorax kaum mit Goldtoment .... *C. rufifrons* Dol.
Tergite äusserst breit und satt goldgelb bandiert. Thorax am ganzen Rand breit golden eingefasst .... *C. bakeri* Krb.

Gruppe RUFOMACULATUS.

Männchen.

1. Thorax ganz schwarz. Kleine Art ...... *C. rufomaculatus* Krb.
Thorax rotbraun .... 2. [(♂♀).
2. Thorax ganz rotbraun, ohne Striemung. Abdomen tiefschwarz .... *C. nigriventris* Brun.
Thorax rotbraun mit 3 schwarzen Striemen *C. aureomaculatus* Krb.

Gruppe ERYTHROCEPHALA.

1. Hinterleib ganz stahlblau. Flügel breit, ganz schwarzbraun mit violettem Schein. *p* mit roten f_1 und f_2. Backen gelbbraun. Thorax weiss übergossen .... *C. erythrocephalus* F.

Gruppe MOROSUS.

Weibchen.

1. Hinterleib ganz schwarz, mit stahlblauem oder purpurnem Schein, ohne Schiller. *p* ganz schwarz. Backen schwarz. Thorax vorherrschend schwarz mit wenig weissem Reif .... *C. morosus* de Meij.
Hinterleib mit Schiller, ganz oder teilweise .... 2.
2. Hinterleibspitze stahlblau. Flügel mit breitem braunem Vorderrand. Sammetmakeln vorhanden .... *C. niponensis* Voll.
Hinterleibspitze ohne jeden stahlblauen Schein.............................. 3.

3. Kopf ganz hellgelb. Flügel schwarzbraun stark irisierend .... *C. philippinensis* Krb.,
Stirn und Scheitel schwarz. 11–12 mm. .. *C. metaxantha* Walk.

Männchen.

1. Hinterleib ganz schwarz, mit stahlblauem oder purpurnem Schein, ohne Schiller. *p* ganz schwarz. Backen schwarz. Thorax vorherrschend schwarz mit wenig weissem Reif .... *C. morosus* de Meij.
Hinterleib ohne stahlblauen Schein, aber ganz oder teilweise mit Schiller .... 2.
2. Kopf ganz hellgelb. Flugel dunkelbraun, stark irisierend .... *C. philippinensis* Krb.
Stirn und Scheitel immer dunkler........ 3.
3. Stirn und Scheitel rostbraun mit Sammetmakeln .... *C. frontosus* Krb.
Stirn und Scheitel schwarz .... 4.
4. Art von 18 mm. .... *C. pseudogigas* Krb.
Art von 11–12 mm..................... *C. metaxantha* Walk.
(Hierher vielleicht *C. sepulchralis* Brun. ? (als *Physocephala*).)

Gruppe PACTYAS.

Weibchen.

1. Kopf ganz weissgelb .... *C. claripennis* Brun. u. var. *ceylonicus* Brun.
Stirn und Scheitel immer dunkler .... 2.
2. Stirn und Scheitel gelbbraun bis rotbraun. Kein Ozellenhöcker .... 3.
Stirn und Scheitel schwarz oder schwarzbraun .... 7.
3. Hinterkopf gelbbraun oder oben rotbraun, unten gelb .... 4.
Hinterkopf schwarz. Rüssel 1½ mal kopflang............................... 6.
4. Hinterkopf ganz gelbbraun ; Schiller quer über die Scheitelblase steigend. Theka sehr gross, grösser als Ring 5–7 zusammen, 4 mm. lang .... *C. sumatrensis* Krb.
Hinterkopf unten gelb, oben rotbraun. Rüssel 1½ × kopflang. Kleine Art...... 5.
5. Abdomen im Grunde rotbraun .... *C. pactyas* Walk.
Abdomen im Grunde rein schwarz....... *C. pactyas* var. *malayensis*, n. var.
6. *f* schwarz. 8 mm. lange Art............ *C. inconspicuus* Krb.
f rotbraun, eventuell oben schwarz. 3. und 4. Tergit seitlich breit und hinten schmal rostrot .... *C. maculiventris* Krb.
(Hierher wohl *C. rufifasciatus* Brun, sehr ähnlich *C. nigripes* Krb., aber mit rotbraunen Sammetmakeln !)
7. Rüssel doppelt so lang wie der Kopf, dünn. 9 mm. lang .... *C. olivaceus* Krb.
Rüssel kopflang, stark .... 8.
8. Kleine zierliche Art von 8–12 mm. *Brachyglossum*-artig .... *C. brevirostris* Krb.
Grosse, robuste Arten von 13–17 mm..... 9.
9. Flügel einheitlich braun, ohne eigentliche Vorderrandbinde .... *C. nigripes* Krb.
Flügel hyalin oder graulich mit schwarzbrauner Vorderrandbinde .... 10.

10. Theka gross gelbbraun .... *C. punctifrons* Krb.
Theka klein, schwarz .... 11.
11. 2. Tergit schwarz mit gelbbraunen Seiten.. *C. celebensis* de Meij.
(vergl. *Physoconops microvalvus* Krb. !).
2. Tergit schwarz, am Hinterrand schimmert unter Silbertoment rotgelber Grund durch .... *C. curtirostris* Krb.

Mannchen.

1. Kopf ganz weissgelb .... *C. claripennis* Brun.
Stirn und Scheitel immer dunkler........ 2.
2. Stirn und Scheitel gelbbraun bis rotbraun. Kein Ozellenhöcker .... 3.
Stirn und Scheitel schwarz oder schwarzbraun .... 6.
3. Hinterkopf rotbraun, unten gelb .... 4.
Hinterkopf schwarz. *f* rotbraun, eventuell oben schwarz....................... 5.
4. Abdomen im Grunde rotbraun .... *C. pactyas* Walk.
Abdomen im Grunde schwarz .... *C. pactyas* var. *malayensis*, n. var.
5. 3. und 4. Tergit seitlich breit, hinten schmal rostrot. Rüssel 1½ mal kopflang.............................. *C. maculiventris* Krb.
3. und 4. Tergit schwarz, gleich dem 5. mit goldgelber Binde. Rüssel kopflang (vielleicht ein *Physoconops* !) .... *C. tenthrediniformis* Krb.
6. Rüssel dünn, doppelt so lang wie der Kopf. *C. olivaceus* Krb.
Rüssel stark, kopflang .... 7.
7. Kleine, zierliche Arten von 8 mm......... 8.
Grosse, robuste Arten von 13–17 mm..... 9.
8. *p* inclusive Tarsen hell rotgelb. Scheitelblase und eine Strieme der Stirn intensiv rotgelb .... *C. rufitarsis* Krb.
p und Tarsen dunkelbraun. Scheitelblase und eine Strieme der Stirn schwarz .... *C. selangorensis*, n. sp.
9. Flügel einheitlich rotbraun, ohne Binde .. *C. nigripes* Krb.
Flügel hyalin oder graulich mit schwarzbrauner Vorderrandbinde .... 10.
10. 2. Tergit schwarz mit gelbbraunen Seiten.. *C. celebensis* de Meij.
(vergl. *Physoconops microvalvus* Krb.).
2. Tergit schwarz, am Hinterrand schimmert unter Silbertoment rotgelber Grund durch .... *C. curtirostris* Krb.
(Hierher *C. rufofasciatus* Brun., ♂, sehr ähnlich *C. nigripes* Krb., aber mit rotbraunen Stirnmakeln; vielleicht auch *C. annulosus* Big., ♂♀.)

Gruppe RUBRIPES.

1. Hinterkopf hellgelb. *f* und *t* hellrotgelb. Schildchen dunkelrotbraun. 7–8·2 mm. *C. rubripes* Krb.
(Hierher vielleicht *C. japonicus*, n. sp., und *C. mundus* Brun.)

13. PHYSOCONOPS Szil.

Abdomen ganz schwarz. 11 mm. ...... *P. borneensis*, n. sp.
1. Tergit am Hinterrand, 2. an den Seiten gelbbraun. 17 mm. .... *P. microvalvus* Krb.

14. PSEUDOPHYSOCEPHALA, nov. gen.

1. Gesichtsgruben und Kiel schwarz. 2. Abdominalsegment fast parallelrandig, am Ende erweitert, und aus ihm kommt das schmäler beginnende 3. Segment wie aus einer Wulst hervor .... *P. abnorma*, n. sp.

15. PHYSOCEPHALA Schin.

A. *Die bisher nur als palaearktisch bekannten Grenzformen.*

1. Pleuren ohne Schillerstrieme oder schillernden Fleck. Untergesicht und Stirn ohne Strieme .... Gruppe *vittata*.

Männchen:

(1) 3. und 4. Tergit ohne bestäubte Hinterrandbinde .... *P. detecta* Beck.
3. und 4. Tergit mit bestäubter Hinterrandbinde. Hinterleib ganz rotgelb, nur der 2. Ring mit 2 schwarzen Flecken, oder Hinterleib am 2.–4. resp. 5. Ring mit je 2 schwarzen Flecken .... *P. vittata* var. *abdominalis* Krb.

Weibchen:

(1) 2. und 3. Ring mit je 2 schwarzen Flecken. Letzte Segmente hellrotgelb .... *P. vittata* var. *abdominalis* Krb.
Pleuren mit Schillerstrieme oder schillerndem Fleck .... 2.

2. Flügelbinde direkt am Vorderrand, d. h. Vorderrandzelle schwarzbraun .... Gruppe *pusilla*.

Männchen:

(1) Hinterleib ohne schwarze Binden. Thorax vorn vollkommen dicht weissgrau bestäubt .... *P. persica* Beck.
Hinterleib mit schwarzen Binden oder ganz verdunkelt .... 2.
(2) Spitze der Unterrandzelle ± trübe.. *P. pusilla* Meig.
Spitze der Unterrandzelle hyalin mit deutlichem, isoliertem Fleck . *P. sinensis* Krb.

Weibchen:

(1) Flügelbinde abgebrochen. Rest der Unterrandzelle hyalin oder leicht getrübt .... 2.
Flügelbinde reicht bis zur Spitze selber. Thorax vorn dicht weiss bestäubt. Hinterleib mit je 2 Flecken am 2. und 3. Tergit .... *P. persica* Beck.
(2) Hinterleib ohne dunkle Binden, mit je 2 Flecken am 2. und 3. Tergit. Thorax dicht weiss bestäubt .... *P. persica* Beck.
Hinterleib mit dunklen Binden, wenn ganz hell, so doch nie mit 2 Flecken auf einem Ring. Flügel unterhalb der 3. Längsader dunkelbraun gezeichnet .... 3.
(3) Flügelspitze höchstens leicht getrübt .... *P. pusilla* Meig.
Flügelspitze hyalin mit deutlichem, isoliertem Spitzenfleck .... *P. sinensis* Krb.

Vorderrandzelle hyalin oder doch weit blasser als die Flügelbinde .... 3.

3. 1. Hinterrandzelle ganz hyalin .... Gruppe und Art *furax* [Beck.

1. Hinterrandzelle im basalen Teil stets braun tingiert .... Gruppe *truncata*.

Männchen:

(1) Flügelbinde kaum angedeutet, auf eine schwache Trübung zwischen der 1. und 2. bezw. 3. Längsader beschränkt .... 2.

Flügelbinde immer deutlich, meistens schwarzbraun .... 3.

(2) Stirn am Augenrand mit 2 sammetschwarzen Flecken. 8 mm. (M. E. ein *Conops*!) .... *P. pugioniformis* Beck.

Stirn ohne Sammetflecken. 11–15 mm. .... *P. variegata* Meig.

(3) Flügelspitze absolut hyalin; Vorderrandbinde abgebrochen. Hinterleib schwarz gezeichnet. Wangenplatten weiss bereift .... *P. laeta* Beck.

Flügelbinde füllt die ganze Unterrandzelle aus, eventuell die Spitze etwas aufgehellt .... 4.

(4) Thorax mit 2 sammetschwarzen Makeln .... *P. punctithorax* Beck.

Thorax ohne Sammetmakeln .... *P. zarudnyi* Beck.

Weibchen:

(1) Flügelbinde deutlich braun. Unterrandzelle ganz ausgefüllt. Wangenplatten glänzend weiss.......... *P. laeta* Beck.

Flügelbinde kaum angedeutet, auf eine schwache Trübung zwischen der 1. und 2. bezw. 3. Längsader beschränkt .... 2.

(2) Theka glänzend rostbraun. Flügel fast ganz wasserklar. 8 mm..... *P. pugioniformis* Beck.

Theka unten schwarz, oben hell rotgelb. 13–16 mm. .... *P. variegata* Meig.

B. *Die rein orientalischen Arten.*
(Unberücksichtigt bleibt *P. yezoënsis* Mats.)

Männchen.

1. Unterrandzelle bis zur Spitze braun ausgefüllt .... 2.

Unterrandzelle bis zum Ende der 2. Längsader braun, meistens plötzlich abgebrochen, und das Ende der Zelle ± aufgehellt oder hyalin .... Gruppe *calosa*. 17.

2 1. Basalzelle ganz braun, Discalzelle wenigstens z. T. braun......... ...... Gruppe *bipartita*. 3.

1. Basalzelle ganz klar .... 11.

3. Rostrote Art mit goldgelb tomentiertem Abdomen und eigentlich ganz hellbraun tingierten Flügeln, von denen nur der Hinterrand unscharf aufgehellt ist...... *P. aureopygia* Krb.

	Dunkle Arten mit scharfbegrenzter, mehr schwarzbrauner Flügelbinde	4.
4.	f_3 mit deutlichem, schwarzbraunem, breitem Band oder fast ganz schwarz	5.
	f_3 fast ganz rotgelb, ohne Band oder nur sehr unklar verdunkelt	10.
5.	Discalzelle und 1. Hinterrandzelle vollkommen braunschwarz (vergl. *bicolorata* Brun.!)	*P. aterrima* Krb.
	Discalzelle und 1. Hinterrandzelle mit hellem Spitzenfleck	6.
6.	Schildchen und Hinterrucken rotbraun	7.
	Schildchen und Hinterrücken schwarz	8.
7.	Stirn ohne jede schwarze Zeichnung	*P. sauteri* Krb.
	Stirn mit schwarzer Strieme	*P. scutellata* Krb.
8.	Stirn ganz glanzend schwarz. 2. Hinterleibsegment fast so lang wie das 3.–5. Segment zusammen	*P. ammophiliformis* Krb.
	(Ich vermute, dass diese Art identisch ist zu *Conops gigas* Macq.!)	
	(Hierher wohl *P. lugens* Voll.)	
	Stirn mit schwarzer T-Strieme	9.
9.	Art von 14–15 mm. Thorax mit Goldschimmer	*P. philippinensis* Krb.
	Art von 10 mm. Thorax mit weissem Schimmer	*P. bipartita* Dol.
10.	Discalzelle ganz braun oder gelbbraun (Nach der Zeichnung ist die Flügelbinde abgebrochen!)	(?) *P. aurantiaca* Brun.
	Discalzelle mit klarem Spitzenfleck. 3. Abdominalsegment vorn rotbraun, hinten schwarz, goldtomentiert	*P. rufescens* Brun.
11.	Flügelbinde die Unterrandzelle bis zur Spitze ausfüllend. Stirn mit T-Zeichnung	Gruppe *sumatrensis*. 12.
	Flügelbinde vor der Spitze der Unterrandzelle abgebrochen, die Spitze ±grau, oft mit isoliertem Spitzenfleck	13.
12.	Schildchen schwarz; aller Schiller weiss	*P. sumatrensis* Krb.
	Schildchen rotbraun; Schiller gelb. Thorax rotbraun. (Vielleicht das ♂ zu *P. renschi* Krb. ♀!)	*P. assamensis* Krb.
13.	Vorderrandzelle braun	Gruppe *limbipennis*. 14.
	Vorderrandzelle heller oder hyalin	15.
14.	Stirn braun, in der Mitte rotgelb (vergl. *P. diffusa* Brun.!)	*P. limbipennis* de Meij.
	Stirn hellgelbbraun mit kleinem braunem Fleck am Beginn der Scheitelblase, dessen Mitte grubig vertieft ist	*P. limbipennis* var. *annulata* Krb.
15.	Flügelbinde durchaus deutlich	16.
	Flügelbinde allmählich verschwindend, eigentlich zwischen r_2 und r_3 beschränkt (vergl. *variegata* Meig.!)	*P. munda* Brun.
16.	Thorax rotbraun, eventuell mit schwarzer Mittelstrieme	*P. argentifera* Brun
	Thorax rostbraun mit 3 zusammengeflossenen schwarzen Striemen (vergl. *P. detecta* Beck.!)	*P. nursei* Brun.

17. Flügelbinde die ganze Vorderrandzelle braun ausfullend .... 18.
Vorderrandzelle heller tingiert oder hyalin. *P. argentifera* Brun.

18. 2. und 3. Fühlerglied schwarz .... *P. atricornis* Brun.
2. und 3. Fühlerglied rotgelb............ 19.

19. Thorax ganz rostbraun, eventuell mit 3 zusammengeflossenen Striemen .... 20.
Thorax ganz schwarz .... 21.

20. Stirn und Scheitel ohne jede schwarze Zeichnung (vergl. *P. persica* Beck. und *P. pusilla* Meig. !).................. *P. calopa* Brun.
Stirn mit V-förmiger Zeichnung (?) ...... *P. albofasciata* Brun.

21. Stirn ganz schwarz............. *P. sepulcralis* Brun. (*Conops* ?).
Stirn mit schwarzer T-Strieme .... *P. annulifera* Brun.
(Hierher vielleicht *P. inconsequens* Brun. und *P. rufohalterata* Brun.)

Weibchen.

1. Unterrandzelle bis zur Spitze braun ausgefüllt............................ 2.
Unterrandzelle bis zum Ende der 2. Langsader braun, meistens plötzlich abgebrochen und der Rest sehr aufgehellt oder hyalin .... Gruppe *calopa*. 19.

2. 1. Basalzelle ganz braun, Discalzelle z. T. braun .... Gruppe *bipartita*. 3.
1. Basalzelle ganz klar .... 11.

3. Rostrote Art mit goldgelb tomentiertem Abdomen und eigentlich mit ganz hellbraunen Flügeln, deren Hinterrand etwas heller ist .... *P. aureopygia* Krb.
Dunkle Arten mit scharfbegrenzter dunkelbrauner Flügelbinde................. 4.

4. f_3 mit deutlichem breitem schwarzem Band oder fast ganz schwarz .... 5.
f_3 ganz rotgelb, ohne Band oder nur sehr unklar verdunkelt .... 9.

5. Discalzelle und 1. Hinterrandzelle vollkommen braunschwarz (vergl. *P. bicolorata* Brun. !) .... *P. aterrima* Krb.
Discalzelle und 1. Hinterrandzelle mit hellem Spitzenfleck .... 6.

6. Schildchen und Hinterrücken rotbraun. Stirn ohne schwarze Zeichnung ...... *P. sauteri* Krb.
Schildchen und Hinterrücken schwarz .. 7.

7. Stirn ganz glänzend schwarz. 2. Segment fast so lang wie das 3.–5. zusammen (vielleicht identisch mit *C. gigas* Macq.).. *P. ammophiliformis* Krb.
Stirn mit schwarzer T-Strieme .... 8.

8. Art von 14–15 mm. Thorax mit Goldschimmer .... *P. philippinensis* Krb.
Art von 10 mm. Thorax weiss tomentiert .... *P. bipartita* Dol.

9. Discalzelle ganz braun oder gelbbraun.... *P. aurantiaca* Brun.
Discalzelle mit klarem Spitzenfleck ...... 10.

10. 3. Abdominalsegment ganz rotbraun, eventuell mit schwarzem Hinterrand.... *P. nigrofasciata* Brun.
3. Abdominalsegment vorn rotbraun, hinten schwarz, goldtomentiert .... *P. rufescens* Brun.

11. Unterrandzelle bis zur Spitze braun ausgefüllt. Stirn mit T-Strieme ... Gruppe *sumatrensis* Krb. 12.

Unterrandzelle bis zum Ende von r_2 braun, der Rest ±grau, oft mit isoliertem Spitzenfleck .... 14.

12. Schildchen schwarz. Aller Schiller weiss. *P. sumatrensis* Krb.
Schildchen rotbraun; Schiller gelb ...... 13.

13. Thorax schwarz .... *P. renschi* Krb.
Thorax rotbraun .... *P. assamensis* Krb.

14. Vorderrandzelle braun................. Gruppe *limbipennis*. 15.
Vorderrandzelle heller als die Binde oder hyalin .... 17.

15. 2. Abdominalsegment parallelrandig; 3. plötzlich abgesetzt; 3.–5. einschliesslich gleich breit .... *P. paralleliventris,* n. sp.
2. Abdominalsegment allmählich in das 3. übergehend .... 16.

16. Stirn braun, nur die Mitte rotgelb (vergl. *diffusa* Brun.!) .... *P. limbipennis* de Meij.
Stirn hellgelb, mit kleiner brauner Makel am Beginn der Scheitelblase, deren Mitte grubig vertieft ist .... *P. limbipennis* var. *annulata* Krb.

17. Binde durchaus deutlich .... 18.
Flügelbinde allmählich verschwindend, eigentlich auf eine Trübung zwischen r_2 und r_3 beschränkt................. *P. munda* Brun.

18. Thorax rotbraun, eventuell mit schwarzer Mittelstrieme .... *P. argentifer* Brun.
Thorax rotbraun mit 3 zusammengeflossenen Striemen (vergl. *P. detecta* Beck.!) .... *P. nursei* Brun.

19. Vorderrandzelle heller als die Flügelbinde. Thorax ganz rostbraun mit feiner schwarzer Mittelstrieme .... *P. argentifera* Brun.
Vorderrandzelle braun. Thorax schwarz. Stirn mit V-förmiger Zeichnung........ *P. albofasciata* Brun.
(Hierher vielleicht *P. diffusa* Brun., *P. tenella* Big. und *P. testacea* Macq.)

Bei der letzten Gruppe habe ich mich eng an Brunetti's Tabellen angelehnt, glaube aber kaum, dass die Arten hiernach bestimmt werden können.

VERZEICHNIS DER ARTEN

(einschliesslich der Arten der benachbarten palæarktischen Gebiete).

1. Gattung TROPIDOMYIA Will.

Canad. Entomol. vol. 22, p. 11 (1888).

Typus, *T. bimaculata* Will., *l. c.* p. 11 (1888).

1. *T. frontosa*, n. sp., ♂.—Malayen St., Kedah.

2. Gattung MICROBRACHYCERÆA, gen. nov.

Typus, *M. pendleburyi* Brun., J. F. M. S. Mus. vol. 13, p. 202 (1927).

1. *M. pendleburyi* Brun., ♂, *l. c.* p. 202 (1927) [*Microconops*].—Selangor.

3. Gattung NEOBRACHYCERÆA Szil.

Ann. Mus. Hung. vol. 24, p. 587 (1926).

Typus, *N. obscuripennis* Krb., Entomol. Mitt. Berlin vol. 7, p. 277 (1913).

1. *N. obscuripennis* Krb., ♂♀, Entomol. Mitt. Berlin vol. 7, p. 277 (1913) [*Brachyceræa*].—Formosa.
2. *N. obscuripennis* var. *nigrita* Krb., ♂, Stettin. Ent. Zeitg. vol. 98, p. 98 (1937) [*Neobrachyglossum*, lapsus !].—China, Kiangsi.

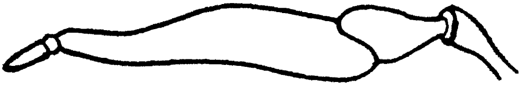
4. Gattung PLEUROCERINELLA Brun.

Fauna Brit. Ind. vol. 3, p. 368 (1923).

Typus, *P. dioctriæformis* Brun., *l. c.* p. 368 (1923).

1. *P. dioctriæformis* Brun., ♂♀, *l. c.* p. 368 (1923).—Ceylon, S. Rhodesia.
2. *P. violacea* Krb., ♂, Zool. Anz. vol. 89, p. 72, f. 7 (1930).—W. Flores.

Fig. 27.



Pleurocrinella dioctriæformis Brun., ♂. Fuhler.

5. Gattung CONOPS L.

Fauna Suecica, p. 467 (1761).

Typus, *C. macrocephala* L., *l. c.* p. 467, n. 1902 (1761).

1. *C. annulosus* Big., ♂♀, Ann. Soc. Ent. France, sér. 6, vol. 7, p. 36 (1887).—Molukken, Simla.
2. *C. aureomaculatus* Krb., ♂♀, Arkiv f. Zool. vol. 26 A, Nr. 2, p. 16, fig. 13 (1933).—China, Mandschurei.
3. *C. bakeri* Krb., ♂♀, Philipp. J. Sci. vol. 34, p. 343 (1927).—Philippinen.
4. *C. brevirostris* Krb., ♀, Arch. Natg. vol. 81 A, 7, p. 53 (1915).—Burma.
5. *C. celebensis* de Meij., Tijdschr. v. Entom. vol. 53, p. 165 (1910).—Celebes.

6. *C. claripennis* Brun., ♂♀, Fauna Brit Ind. Dipt. vol. 3, p. 345 (1923).—India or.
7. *C. claripennis* var. *ceylonicus* Brun.. ♂♀, *l. c.* p. 346 (1923).—Ceylon.
8. *C. curtirostris* Krb., ♂♀, Arch. Natg. vol. 81 A, 7, p. 52 (1915) [als *celebensis* de Meij. !].—Sikkim.
9. *C. curtulus* Coqu., ♂, Proc. U. St. Nat. Mus. vol. 21, p. 328 (1898).—Japan.
10. *C. erythrocephalus* F., ♂♀, Ent. Syst. vol. 4, p. 392 (1850).—Ind. or., Africa mer.
11. *C. flavonervosus*, n. sp., ♀.—Japan.
12. *C. frontosus* Krb , ♂. Arch. Natg. vol. 81 A, 7, p. 57 (1915). Sikkim.

C. gigas Macq.=*Physocephala.*

13. *C. hanaxonensis* Mats., ♂♀ ?, Thous. Ins. Jap. Add. 2, p. 267, t. 18, f. 10 (1916).—Japan.
14. *C. inconspicuus* Krb., ♀, Zool. Anz. vol. 89, p. 70, f. 4 (1930).—W. Flores.

C. indicus Krb.=*C. nubeculosus* Big., var.

C. intermedius Brun.=*nigrofasciatus* Krb.

15. *C. japonicus* Krob., Ann. & Mag. Nat. Hist. (11) iv. p. 367 (1939). ♀.—Japan.
16. *C. javanicus* Dol., ♂♀ ?, Nat. Tijdsch. Ned. Ind. vol. 10, p. 409 (1856), t. 4, f. 2.—Java.
17. *C. jozankeanus* Mats., ♂♀ ?, Thous. Ins. Jap Add. 2, p. 249 (1916).—Japan.
18. *C. maculifrons* Krb., ♂, Arch. Natg. vol. 81 A, 11, p. 41 (1915).—Amur.
19. *C. maculiventris* Krb., ♂♀, *l. c.* p. 50 (1915).—Sikkim. Burma.
20. *C. methaxanthus* Walk., ♂♀, Proc. Linn. Soc. vol. 7, p. 225 (1864).—Waigoe, W.-Sumatra, Sarawak, N. Guinea.

C. microvalvus Krb.=*Physoconops.*

21. *C. morosus* de Meij., ♂♀, Tijdschr. v. Ent. vol. 67, p. 213 (1924).—Java.
22. *C. mundus* Brun., ♂, Record Ind. Mus. vol. 7, p. 496 (1912).—Ind. or.
23. *C. nigricans* Mats., ♂♀ ?, Thous. Ins. Jap. Add. 2, p. 268, t. 18, f. 11 (1916).—Japan.
24. *C. nigrifrons* Krb., ♂. Arch. Natg. vol. 81 A, 11, p. 55 (1915).—Japan.
25. *C. nigripes* Krb., ♂♀, Entom. Mitt. Berlin vol. 2, p. 278 (1913).—Formosa.

26. *C. nigriventris* Brun., ♂, Fauna Brit. Ind. Dipt. vol. 3, p. 346 (1923).—Assam.
27. *C. nigrofasciatus* Krb., ♀, Arch. Natg. vol. 81 A, 7, p. 46 (1915).—Rangoon.
    intermedius Brun., ♂, Fauna Brit. Ind. Dipt. vol. 3, p. 353 (1923).—Ind. or.
28. *C. niponensis* Voll., ♀, Versl. Med. K. Akad. vol. 15, p. 10 (1863).—Japan.
29. *C. nubeculosus* Big., ♂♀, Ann. Soc. Ent. France, sér. 6, vol. 7, p. 36 (1887).—Ind. or., Australien.
30. *C. nubeculosus* var. *brunneomaculatus*, n. var., ♀.—Philippinen.
31. *C. nubeculosus* var. *fulvicornis* Krb., ♂, Entom. Mitt. Berlin vol. 2. p. 279 (1913).—Formosa.
32. *C. nubeculosus* var. *indicus* Krb., ♂♀, Arch. Natg. vol. 81 A, 7, p. 45 (1915).—Sikkim.
33. *C. nubeculosus* var. *ornatus* Big., ♀, Bull. Soc. Zool. de France vol. 17, p. 211 (1892).—Ind. or.
    bigoti Brun., n. nom., Rec. Ind. Mus. vol. 27, p. 78 (1925).
34. *C. olivaceus* Krb., ♂♀, Philipp. J. Sci. vol. 34, p. 344 (1927).—Philippinen.
35. *C. opimus* Coqu., ♂, Proc. U.S. Nat. Mus. vol. 21, p. 329 (1898).—Japan.
36. *C. pactyas* Walk., ♂♀, Dipt. Saund. vol. 4, p. 255 (1852).—Java, Burma.
37. *C. pactyas* var. *malayensis*, n. var., ♂♀.—Malayen-Halbinsel, Kedah.
38. *C. philippinensis* Krb., ♂, Philipp. J. Sci. vol. 34, p. 340 (1927).—Philippinen.
39. *C. pseudogigas* Krb., ♂, Arch. Natg. vol. 81 A, 11, p. 55 (1915).—Burma.
40. *C. punctifrons* Krb., ♀, *l. c.* p. 52 (1915).—Sikkim.
41. *C. rubripes* Krb., ♀, Zool. Anzeiger vol. 89, p. 68, f. 2 (1930).—Flores.
42. *C. rufifrons* Dol., ♂♀, Nat. Tijdschr. Ned. Ind. vol. 14, p. 412, t. 8, f. 1 (1857).—Amboina.
43. *C. rufitarsis* Krb., ♂, Zool. Anzeiger vol. 89, p. 69, f. 3 (1930).—West-Flores.
44. *C. rufofasciatus* Brun., ♂♀, Fauna Brit. Ind. Dipt. vol. 3, p. 353 (1923).—Simla.
45. *C. rufomaculatus* Krb., ♂♀, Arch. Natg. vol. 81 A, 11, p. 44 (1915).—Formosa.

46. *C. selangorensis*, n. sp., ♂.—Selangor.
47. *C. sepulchralis* Brun., ♂, Fauna Brit. Ind. Dipt. vol. 3, p. 348 (1923).—Assam.
48. *C. sumatrensis* Krb., ♀, Arch. Natg. vol. 81 A. 7, p. 49 (1915).—Sumatra.
49. *C. tenthrediniformis* Krb., ♂, *l. c.* p. 51 (1915).—Burma.

6. Gattung Macroconops Krb.

Konowia vol. 6, p. 125 (1927).

Typus, *M. helleri* Krb. *l. c.* vol. 6, p. 126 (1927).

1. *M. helleri* Krb., ♀, *l. c* vol. 6, p. 126, figs. 1. 2 (1927).—China.

7. Gattung Physoconops Szil.

Ann. Mus. Hung. vol. 24, p. 588 (1926).

Typus, *P. pictus* F., Ent. Syst. vol. 4, p. 391 (1794).

1. *P. borneensis*. n. sp., ♂.—Borneo.
2. *P. microvalvus* Krb., ♂♀, Zool. Anzeiger vol. 89, p. 71, f. 5 (1930) (? *celebensis* de Meij. ?).—Java.

8. Gattung Pseudophysocephala, gen. nov.

Typus, *P. platycephala* Lw. Neue Beitrg. p. 35 (1853) [*Conops*].

1. *P. abnorma*, n. sp., ♂.—Selangor.

9. Gattung Physocephala Schin.

Wiener Ent. Monatsschr. vol. 5. p. 137 (1861).

Typus, *P. nigra* Deg., Ins. vol. 4, p. 105, t. 15, f. 9 [*Conops*] (1776).

1. *P. albofasciata* Brun., ♂♀, Rec. Ind. Mus. vol. 7, p. 497 (1912).—Ind. or.
2. *P. ammophiliformis* Krb., ♂, Arch. Natg. vol. 81 A, 4, p. 122, t. 4, f. 25 (1915).—Burma.
3. *P. annulifera* Brun., ♂, Rec. Ind. Mus. vol. 7, p. 498 (1912).—Assam.
   P. annulosa Big. = *Conops annulosus* Big.
4. *P. argentifera* Brun., ♂♀, Fauna Brit. Ind. Dipt. vol. 3, p. 361 (1923).—Bengalen.
5. *P. assamensis* Krb., ♀, Arch. Natg. vol. 81 A, 4, p. 121 (1915).—Assam.

6. *P. atricornis* Brun., ♂, Fauna Brit. Ind. Dipt, vol. 3, p. 363 (1923).—Lahore.
7. *P. aterrima* Krb., ♂♀, Arch. Natg. vol. 81 A, 4, p. 122 (1915).—Sikkim.
8. *P. aurantiaca* Brun., ♂♀, Fauna Brit. Ind. Dipt. vol. 3, p. 358 (1923) —Bengalen, Ceylon.
9. *P. aureopygia* Krb., ♂♀, Arch. Natg. vol. 81 A, pp. 123 (1915).—Sikkim, Australia.
10. *P. bicolorata* Brun., ♂♀, n. nom. pro *bicolor* Brun., Rec. Ind. Mus. vol. 27, p. 79 (1925).
    bicolor Brun., ♂♀., Fauna Brit. Ind. Dipt. vol. 3, p. 357 (1923).—Darjeeling, Nepal.
11. *P. bipartita* Dol., ♂♀, Nat. Tijdschr. Ned. Ind. vol. 17, p. 100 (1858–59).—Amboina, Sumatra, Palong Pegu.
12. *P. calopa* Big., ♂, Ann. Soc. Ent. France, sér. 6, vol. 7, p. 334 (1887).—Pondicherry
    quadrata Brun. Rec. Ind. Mus. vol. 9, p. 274 (1913).—Ost Himalaya.
13. *P. detecta* Beck., ♂, Ann. Mus. Zool. St. Petersb. vol. 17, p. 615 (1913).—Persisch Belutschistan.
14. *P. diffusa* Brun., ♂♀, Fauna Brit. Ind. Dipt. vol. 3, p. 365 (1923).—Bengalen.
15. *P. furax* Beck., ♂♀, Ann. Mus. Zool. St. Petersb. vol. 17, p. 612 (1913).—Persisch Belutschistan.
16. *P. gigas* Macq., ♀, Dipt. Exot. vol. 2, pt. 3, p. 10 (1843) [*Conops*].—Java.
17. *P. inconsequens* Brun., ♂, J. F. M. S. Mus. vol. 13, pt. 4, p. 204 (1927).—Malayen Staat.
18. *P. læta* Beck., ♂♀. Ann. Mus. Zool. St. Petersb. vol. 17, p. 613 (1913).—Persisch Belutschistan.
19. *P. limbipennis* de Meij., ♂♀, Tijd. v. Ent. vol. 53, p. 165 (1910).—Bali, Semarang, Krakatau, Formosa.
    annulata Krb., ♂♀, Ent. Mitt. Berlin vol. 2, p. 281 (1914).
20. *P. lugens* Voll., ♂♀ ?, Versl. Meded. K. Akad. Wetensch. vol. 15, p. 10, f. 3 (1863).—Borneo.
21. *P. munda* Brun., ♂♀, Fauna Brit. Ind. Dipt. vol. 3. p. 361 (1923).—Ind. or.
22. *P. nigrofasciata* Brun., ♂, Rec. Ind. Mus. vol. 7, p. 497 (1912).—Koygar.
23. *P. nursei* Brun., ♂, Fauna Brit. Ind. Dipt. vol. 3, p. 360 (1923).—India or.
24. *P. paralleliventris*, n. sp., ♀.—Travancore.

25. *P. persica* Beck., ♂♀, Ann. Mus. Zool. St. Petersb. vol. 17, p. 609 (1913), t. 14, f. 31.—Pers. Belutsch., Turkmenia, Cypern.
26. *P. philippinensis* Krb., ♂♀, Philipp. J. Sci. vol. 34, p. 338 (1927).—Philippinen.
27. *P. pugioniformis* Beck., ♂♀, Ann. Mus. Zool. St. Petersb. vol. 17, p. 611, t. 14, f. 32 (1913).—Pers. Belutsch.
28. *P. punctithorax* Beck., ♂, *l. c.* vol. 17, p. 611 (1913).—Persisch Belutsch.
29. *P. renschi* Krb., ♀, Zool. Anz. vol. 89, p. 67 (1930).—Sumatra.
30. *P. rufescens* Brun., ♂♀, Fauna Brit. Ind. Dipt. vol. 3. p. 360 (1923).—Kaschmir.
31. *P. rufohalterata* Brun., ♂, J. F. M. S. Mus. vol. 13, p. 203 (1927).—Selangor.
32. *P. sauteri* Krb., ♂♀, Ent. Mitt. Berlin vol. 2, p. 280 (1913).—Formosa.
33. *P. scutellata* Krb., ♂, Arch. Natg. vol. 81 A, 4, p. 118 (1915).—Burma.
34. *P. sepulchralis* Brun.. ♀?, Rec. Ind. Mus. vol. 7, p. 498 (1912).—Assam.
35. *P. sinensis* Krb., ♂♀, Arkiv f. Zool. vol. 26 A, p. 15 (1933).—China.
36. *P. sumatrensis* Krb., ♀, Arch. f. Naturg. vol. 81 A, 4, p. 119 (1915).—Sumatra.
37. *P. tenella* Big., ♂♀, Ann. Soc. Ent. France, sér. 6, vol. 7, p. 35 (1887).—Ceylon, Ind. or.
38. *P. testacea* Macq., ♀, Dipt. Exot. vol. 3, p. 9, t. 1, f. 2 (1847) [*Conops*].—Bengalen, Tasmania.
39. *P. vittata* F. var. *abdominalis* Krb., ♂♀, Arch. Natg. vol. 80 A, 10, p. 57 (1914).—Europa mer., Asia min.. Syria, Mongolia.
40. *P. yezoensis* Mats., ♂♀?, Thous. Ins. Jap. Add. 2, p. 270 (1916).—Japan.
41. *P. zarudnyi* Beck., ♂, Ann. Mus. Zool. St. Petersb. vol. 17, p. 614 (1913).—Persisch Belutsch.

10. Gattung STYLOGASTER Macq.

Hist. Nat. Dipt. vol. 2, p. 38 (1835).

Typus, *S. stylata* F., Syst. Ant. p. 177 (1805).

1. *S. bakeri* Bezzi, ♂♀, Philippine J. Sci. vol. 12, p. 157 (1917).—Philippinen.

2. *S. orientalis* Brun., ♂, Fauna Brit. Ind. Dipt. vol. 3, p. 372 (1923).—Ceylon, Assam, Cochinchina.

11. Gattung ZODION Latr.

Précis des caract. gén. d. Ins. (1796).

Typus, *Z. cinereum* F., Entom. syst. vol. 4, p. 399 [*Myopa*] (1794).

1. *Z. andersoni* Krb. (n. nom. pro *Z. intermedium* Krb.), ♀, Arkiv f. Zool. vol. 26 A, 8, p. 18 (1933).—Mongolia.
2. *Z. cinereum* F., ♂♀, Entom. syst. vol. 4, p. 399 [*Myopa*] (1794).—Europa, Asien, Afrika sept., Ind. or.
3. *Z. griseum* Brun., ♂♀, Fauna Brit. Ind. Dipt. vol. 3, p. 375 (1923).—Kaschmir.
4. *Z. montanum* Brun., ♀, Rec. Ind. Mus. vol. 7, p. 499 (1912).—Ind. or.

12. Gattung MYOPA F.

System. entom. p. 798 (1775).

Typus, *M. testacea* L., Syst. Nat. Edit. 11, vol. 2, p. 1006 [*Conops*] (1759).

1. *M. cincta* F., ♂♀ ?, Ent. Syst. vol. 4, p. 399 (1794).—Ind. or.
2. *M. curta* Krb., ♂, Arch. Natg. vol. 81 A, 7, p. 83 (1915).—Nord Mongolei.
3. *M. dorsalis* F., ♂♀, Ent. Syst. vol. 4, p. 397 (1794).—Europa, Afrika sept., Ind. or.
4. *M. nigriventris* Brun., ♂, Fauna Brit. Ind. Dipt. vol. 3, p. 380 (1923).—Kaschmir.
5. *M. picta* Pz., ♂♀, Fauna Germ., vol. 114, p. 22 (1798).—Europa, Afrika sept., Ind. or.
6. *M. testacea* L., ♂♀, Syst. Nat. Edit. 11, vol. 2, p. 1006 (1759).—Europa, Afrika sept., Kaschmir.
7. *M. variegata* Mg. var. *asiatica* Krb., ♂♀, Arch. Natg. vol. 81 A, 7, p. 77 (1915).—Sibiria, Asia centr.

13. Gattung MELANOSOMA Rob.-Desv.

Dipt. des Env. de Paris, Myop. p. 42 (1853).
Glossizona Rond. Prodr. vol. 1, p. 58 (1856).

Typus, *M. bicolor* Meig., Syst. Beschr. vol. 4, p. 147 [*Myopa*] (1824).

1. *M. bella* Krb., ♂, Konowia vol. 6, p. 124 (1927).—Persien.
2. *M. carbonaria* Krb., ♂♀, Arch. Natg. vol. 80 A, 10, p. 81 (1914)—Asia centr.
3. *M. hyalipennis* Krb., ♂, *l. c.* vol. 80, p. 82 (1914).—Asia min.

14. Gattung Occemyia Rob.-Desv.

Dipt. des Env. de Paris, Myop. p. 50 (1853).

Typus, *O. atra* F., Spec. Ins. vol. 2, p. 469 [*Myopa*] (1781).

1. *O. atra* F., ♂♀, Spec. Ins. vol. 2, p. 469 [*Myopa*] (1781).—Europa, Afrika sept., Asia min., Ind. or.
2. *O. cænovalva* Krb., ♀, Arch. Natg. vol. 81 A, 7, p. 104 (1915).—Formosa.
3. *O. flavipes* Brun., ♀, Fauna Brit. Ind. Dipt. vol. 3. p. 383 (1923).—Ind. or.
4. *O. niitapensis* Mats., ♂♀ ?, Thous. Ins. Jap. Add. 2, p. 292, t. 17, f. 15 (1916).—Japan.
5. *O. ogumæ* Mats., ♂♀ ?, *l. c.* p. 274, t. 17, f. 16 (1916).—Japan, Sacchalin.
6. *O. pusilla* Mg., ♂♀, Syst. Beschr. vol. 4, p. 150 [*Myopa*] (1824).—Europa, Afrika sept., Asia min.
7. *O. sauteri* Krb., ♂♀, Arch. Natg. vol. 81, 7, p. 103 (1915).—Formosa.
8. *O. simillima* de Meij., ♂♀ ?, Bijdrag. tot de dierkunde vol. 18, p. 103 (1914).—Java.

15. Gattung Sicus Scop.

Entom. carn. p. 1004 (1763).

Typus, *S. ferrugineus* L., Fauna Suecica p. 468 [*Conops*] (1761).

1. *S. ferrugineus* L., ♂♀, Fauna Suec. p. 468 (1761).—Europa, Sikkim.
2. *S. ferrugineus* var. *nigricans*, n. var., ♂.—Ussuri.
3. *S. indicus* F., ♂, Ent. Syst. vol. 4, p. 399 (1775) [*Myopa*].—Ind. or.
4. *S. vaginalis* Krb., ♀, Arch. Natg. vol. 81 A, 1, p. 88, t. 7, f. 51 (1915).—Ind. or.

Tropidomyia frontosa, n. sp., ♂. Type: London.

Gleicht ausserordentlich *T. aureifacies* Krb., aber die Stirn trägt einen sattelförmigen schwarzbraunen Fleck, der bis zum Scheitel reicht und neben den Fühlern breit herabsteigt, nur einen ganz schmalen gelben Strich am Augenrand freilassend. Hinterkopf ganz schwarz, am Augenrand weissglänzend. Rüssel und Fühler ganz schwarz. Thorax und Abdomen glanzlos schwarz, mit zartem, weissem Reif. Schulterbeulen kaum etwas rotbraun. Pleuren ohne Schillerstrieme. Platten des Hinterrückens ohne Goldtoment, nur leicht weiss bereift. Hüften schwarzbraun, die vordern gelbbraun. Hinterhüften silberschillernd. *p* schwarz, *f*-spitzen und *t* gelbbraun. Haftläppchen und Klauen gelbbräunlich. Schwinger dunkelbraungelb mit schwarzer Knöpfchenspitze. Abdomen nur am 2. und 5. Ring mit gelber Seitenbinde am Hinterrand, 6. mit goldtomentiertem Mittelfleck. Flügel vom Vorderrand bis r_3 braun, 1. Basalzelle fensterartig hyalin. 1. Hinterrandzelle sehr spitz endend, hier braun tingiert. Discal- und 2. Basalzelle unbestimmt bräunlich verdunkelt. Bei schräger Betrachtung ist der helle Flügelteil irisierend, und zwar rötlich schimmernd, nur die 1. Basalzelle und der Flügellappen grünlich.

Länge 6·5 mm. Fühler 1·5 mm.; Flügellänge fast 6 mm.

Malayenhalbinsel, Kedah Peak, 3300–3950 feet, 14. iii.

MICROBRACHYCERÆA, gen. nov.

Diesen Gattungsnamen wähle ich für *Microconops pendleburyi* Brun. Der Kopf ist gebaut wie bei *Brachyceræa*: das Untergesicht hat ganz flache Gruben, die durch einen äusserst breiten flachen Kiel getrennt sind, dass man fast sagen könnte: Untergesicht flach gekielt ohne Gruben. Das 3. Fühlerglied ist deutlich länger als das 2. Das 1. ist nicht erkennbar imfolge einer Quetschung der Type. Der Griffel scheintun deutlich 3-gliedrig zu sein. Hinterleib wie bei *Physocephala*, sehr dünn gestielt.

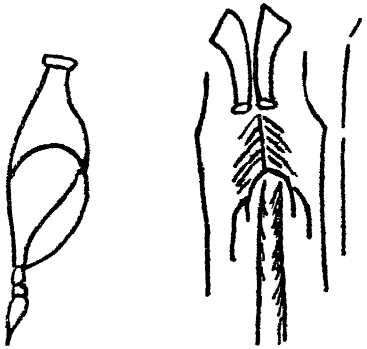
M. pendleburyi Brun., ♂. Type: London.

Länge 5 mm. Fühler ½ mm.; Flügellänge 4·5 mm., -breite ca. 1 mm.

Ueber den Fühlern liegt ein lackartig glänzender gelbbrauner Fleck. Oberer Stirnteil und Scheitel schwarz.

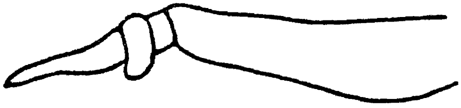
Ozellenfleck deutlich. Fühler dunkelgelbbraun. Rüssel dünn, kopflang. Hinterkopf schwarz, am Augenrand weissschimmernd. Thorax glanzlos, wie angegeben. Tarsen breit gebaut, letztes Glied mit langen schwarzen Haaren. Flügel wie bei *Conops*, aber die 1. Hinterrandzelle ist schmal und beiderseits convex begrenzt, ziemlich lang gestielt. Schuppchen und Schwinger ockergelb. Abdomen sehr dünn gestielt. 2. Ring doppelt so lang wie der 3., gelbbraun, weisslich schimmernd, besonders an der Grenze zum 3. Dieser mit weissschimmerndem Hinterrandsaum. Analsegment weissschimmernd.

Fig. 28.



Microbrachyceræa pendleburyi Brun. Fuhler, Untergesicht.

Fig. 29.



Conops nubeculosus Big., ♀. Fuhlerende.

Conops nubeculosus Big. 2 ♂♂, 1 ♀, nach Brun.'s Angaben mit der Type verglichen. 1 ♂ von Haragena, ii. 7, mit fast ganz braun tingierten Flügeln. 14 mm. Typisch scheint mir die Farbung des 2. Tergits, das nur in der Mitte rotbraun ist, seitlich und hinten aber dicht goldgelb tomentiert. Bengalen.

Conops rufofasciata Brun., ♂, var. von Simla.

Länge 12·5 mm. Fühler 3 mm.; Flügellänge 10·5 mm., -breite 3 mm.

Sehr ähnlich *C. nigripes* Krb. von Formosa, aber 4. und 5. Tergit ganz schwarz, 6. rotbraun, 4. mit goldgelber Binde, 5.–6. gelbtomentiert.

Untergesicht hellgelb, bis zu den braunen Sammetmakeln, silberschimmernd am Augenrand. Stirn dunkler gelb, am Augenrand ein brauner, dreieckiger Fleck, desgleichen einer in der Mitte: Reste einer Querbinde darstellend. Scheitel gelbbraun, mit kleinem schwärzlichen Ozellenfleck. Hinterkopf schwarzbraun, am Augenrand braun mit Silberschimmer. Rüssel dünn, ca. 1½ mal kopflang. Fühler schwarz, 3. Glied unten düster rotbraun. 1. ca. 2½ mal (nicht 1½ mal wie Brun. schreibt) so lang wie breit. 2. fast 3 mal so lang wie das 1., 3. ca. ¾ vom 2. Thorax düster chokoladebraun, die Platte schwarz, matt, Hinterrücken unten schwarz. Pleuren grösstenteils schwarz, weisslich schimmernd, nur innerhalb der Schulterbeulen weissschillernd. *p* rotbraun. *f* oben, namentlich f_1, etwas dunkler. Tarsen schwarz. Haftläppchen und Klauen bräunlichgelb, Spitzen schwarz. Schwinger rotgelb. Flügel etwas schmutzig rotbraun tingiert, bis zur 3. Längsader dunkler, aber mit helleren Partien. Vorderrandzelle heller. Hinterleib eigentlich schwarz, 1.-3. Ring (ohne den Hinterrand) tief mattschwarz, der Rest zart gelblich tomentiert. 2.-4. Segment mit leuchtend düsterrotgelber Binde, die am 3. und 4. hinten einen seidigen Saum trägt. Bauch vom 3. Ring an etwas rotbraun. Genitalien ganz rotbraun.

Conops intermedius Brun., ♂, von Chapra, Bengalen. Type: London.

Länge 13 mm. Fühler 4 mm.; Flügellänge 9 mm., -breite 3 mm.

Vorherrschend rostbraun. Hinterleib seitlich, wenigstens oben, mehr olivbraun, aber vollkommen dicht goldgelb tomentiert. Kopf ganz hell rotgelb, nur die Gruben weissgelb. Keine Sammetmakeln am Augenrand. Nur ein schmaler, schwarzer Strich oberhalb des Fühlerhöckers bis zur Scheitelblase. Untergesicht goldgelb tomentiert. Stirn ohne Schiller. Fühler ganz hellrotgelb. 1. Glied ca. 5–6 mal länger als breit, 2. ca.

$1\frac{3}{4}$ mal so lang wie das 1., 3. gleich dem 1. Griffel fehlt. Rüssel hellrotbraun, ca. $1\frac{1}{2}$ mal kopflang. Hinterkopf rotbraun, goldgelb schimmernd. Thorax und Hinterrücken rostbraun; Toment gelblich, am Hinterrücken satt goldgelb. Pleuren mit Tomentbinde. *p* hellrotgelb, *t*-basis gelblich. Tarsen hellrostrot. Haftläppchen und Klauen gelbrot, die Spitzen schwarz. Schwinger rotgelb. Flügel wie bei *C. nubeculosus*, zart gelblich tingiert, z. T. dunkler, braun, namentlich nach der Spitze zu. Beide Basalzellen und die Discalzelle bilden ein helles Fenster. Adern hellbraun, Vorderrandader rostrot. Hinterleib unten und seitlich rostrot, oben dicht goldgelb tomentiert, am 2.-4. mit olivbraunem Fleck: 2. mit Längsfleck, 3. und 4. mit Vorderrandbinde, die in der Mitte dreieckig ausgezogen ist.

Ich halte die Art für synonym mit *C. nigrofasciatus* Krb.

Conops nigriventris Brun., ♂, von Khasi Hills, Ind. Type: London.

Länge 13·7 mm. Fühler fast 4 mm.; Flügellänge 11 mm., -breite 3·5 mm.

Gehört habituell zu *C. nigripes* Krb. Kopf rötlichgelbbraun. Die rotgelben Stirnmakeln kommen dadurch zu stande, dass sich um sie ein Ring von weissgelber Färbung herumzieht. Scheitelblase gelbbraun, ziemlich stark gewölbt, mit deutlichem Ozellenhöcker, der 2 Ozellen trägt. Rüssel kurz, dick, schwarzbraun. 1. Fühlerglied 3 mal so lang wie breit; 2. doppelt so lang wie das 1.; 3. ca. $\frac{2}{3}$ vom 2., leuchtend rotgelb; 2. Glied dicht kurz schwarz beborstet. Die Art würde auch in die *nubeculosus*-Gruppe passen. Backen etwas gelbschimmernd. Der ganze Thorax rostbraun, Hinterrücken unten in der Mitte mit unscharfem schwarzem Fleck. Sternopleure mit 4–5 starken schwarzen Borsten. Hüften rostbraun, etwas gelblich schimmernd. *p* gelbbraun, f_3-basis oben etwas schwärzlich verdunkelt. Tarsen schwarz. Haftläppchen und Klauen gelblich, Spitzen schwarz. *t* gelbschimmernd, f_3 mit ziemlich langer schwarzer, dichter Behaarung. Schwinger rotgelb. Flügel gelblich tingiert, Vorderrand bis-*vena spuria* braungelb. 1. Hinterrandzelle typisch für *Conops* an der Spitze ±aufgehellt. Grenze der 2. Basalzelle. Discalzelle und Raum vor der Analzelle braun tingiert. Abdomen spindelförmig, wie bei *nigripes*, ziemlich stark, glanzlos, dicht stark schwarz beborstet. Nur die Genitalien braungelb und die Seiten des 2. Tergits unbestimmt braungelb schimmernd.

Conops punctifrons Krb., ♂, von Formosa Shinsinei, Nördl. Paiwan Distr., 4000 feet, x. Type ♂: Dahlem.

Länge 13 mm. Fühler fast 4 mm.; Flügellänge 9 mm., -breite 3·5 mm.

Sehr ähnlich dem ♀. Rüssel 1½ mal kopflang. Stirn und Scheitel stark gefurcht. Backen gleich dem Untergesicht satt dunkelgoldgelb schillernd. 1. Fühlerglied ca. 5 mal so lang wie breit; Endgriffel ohne Seitenfortsatz. Scheitelblase dunkel rostrot mit dunkler Mitte. Sammetmakeln gross, schwarz. Schildchen schwarz. Hüften rotbraun. Hinterleib auch am 3. Ring mit goldgelber, scharfbegrenzter Hinterrandbinde. 6. Ring schwarz, grösstenteils goldgelb tomentiert. Flügelbinde eigentlich vom Vorderrand bis zur r_3. Vorderrandzelle kaum etwas heller. 1. Hinterrandzelle ganz hell unterhalb der *vena spuria*.

Conops metaxanthus Walk., ♂♀, von West Sumatra, Type ♀: London.

♂. Schiller nur am Untergesicht intensiv goldgelb, sonst mehr weisslich. Thorax vor der Quernaht und vor dem Schildchen zart weissschimmernd. *f* mehr dunkelrotbraun, das Spitzendrittel von f_{1+2} ist unten scharf begrenzt hellrotgelb. Hinterleib am 1. und vom 4. Ring ab gelbgrau tomentiert; 2. und 3. glanzlos schwarz. Vielleicht haben die Tiere durch das Tötungsmittel gelitten.

♀. Type vom gleichen Ort, Benkoelen, 10 mm. Gleicht in allem dem ♂. Schiller des ganzen Kopfes weiss statt gelb. *p* heller als beim ♂. Flügel etwas dunkler tingiert. Hinterleib eigentlich glänzend schwarz, nur vom 5. Ring an gelblich tomentiert. Theka dornförmig, länger als das Analsegment, schwarz, Vorderseite düsterrotbraun. 1 ♀ von Benkoelen hat am 1. und 2. Tergit breite, mattgraugelbe Tomentbinden. f_3 hellrotgelb mit schwärzlicher Spitze. Hüften und *t* ausserordentlich intensiv silberschillernd. Hinterrücken etwas olivenbräunlich schimmernd.

1 ♀ von Quop, W. Sarawak, ist etwas grösser, 12·2 mm. Die Theka scheint verhältnismässig grösser zu sein und ist vorn heller rostrot. Schiller an Kopf und Hüften goldgelb, an den *p* weiss.

Conops pactyas Walk. (nach Bestimmung von Brun.), ♂♀.

♂. Länge 11·5 mm. Fühler 3·5 mm.; Flügellänge 9·2 mm., -breite 2·5 mm.

♀. Länge 12 mm. Fühler 4 mm.; Flügellänge 10 mm., -breite 3 mm.

♂. Stirn dunkelrotbraun mit tiefen Querrillen. Kein Ozellenhöcker. Sammetmakeln schwarz, klein. Der Hufeisenfleck schmal. Fühlerhöcker oben ganz schwarz. Untergesicht rotgelb, satt goldgelb glänzend. Kiel in der untern Partie schwarz. Augenrand oberhalb der Makel linienfein, goldschillernd. Rüssel dunkelrotbraun, an beiden Enden schwarz. ca. 2 mal kopflang. 1. Fühlerglied lang, ca. $\frac{2}{3}$ vom 2., oben schwarz. 3. so lang wie das 1., schwarz. unten düsterrotbraun. Hinterkopf schwarz, gelb tomentiert. Thorax, Schildchen, Hinterrücken ganz schwarz, nur die Schulterbeulen rotbraun. Schwinger rotgelb. Der Schiller ist graulich. Vorderhüften rotgelb, die andern schwarz, gelbgrau tomentiert. *p* rotbraun, *f* oben unbestimmt verdunkelt. f_3 grösstenteils schwarz, die Spitze rostbraun. *t* heller, die äusserste Spitze schwarz. Tarsen schwarz, Metatarsen der p_3 bräunlich. Haftläppchen und Klauen rotgelb, Spitzen schwarz. Abdomen schwarz, glanzlos. 1. Ring hinten durch Toment graugelb, 2.–4. mit breiter goldgelber Binde, Hinterrand des 5. und 6. gelb tomentiert. Genitalien etwas rotbraun. Flügel schmutzig graubraun tingiert. Flügelbinde zwischen Randader und r_3. 1. Hinterrandzelle bis zur *vena spuria* dunkelschwarzbraun. Discalzelle unten von einem braunen Strich begleitet.—Sikkim, Darjeeling, iv.

♀, von Khasi Hills, Assam. Gleicht dem ♂, aber Kopf viel heller. Stirn und Scheitel z. T. mit hellrotgelben Partien. Fühlerhöcker oben grösstenteils rotbraun. Fühler rotbraun. Alle *f* grösstenteils schwarz. Hinterleib ganz schwarz. 2.–4. Ring mit satt goldgelber Binde. Theka sehr klein, schwarz. Schwinger und Flügel wie beim ♂.

Mir liegen z. Z. 2 Ex. aus Java-Preanger vor, die m. E. viel besser zu der Originaldiagnose passen, als die Brunettischen Tiere.

♂♀ messen allerdings 15 mm.! Fühlerhöcker oben dunkelrostrot. Rüssel rostrot mit dunkler Spitze. Hinterkopf rostrot, goldschillernd, auch quer über die Scheitelblase herüber. Alle Hüften rotgelb, alle *f* rostrot, die *t*-spitzen bräunlich verdunkelt. Haftläppchen und Klauen weissgelb. Pleuren und Seiten des Hinterleibes ±rotbraun. 1. Ring goldgelb tomentiert, 2., 4. und 5. am Hinterrand, Analsegment mit grossem Fleck. 3. Ring am Hinterrand rotbraun. Beim ♀ ist Stirn und Scheitel fast bis zu Schwarz verdunkelt.

Conops pactyas var. *malayensis*, n. var., ♂♀, von Malayen Halbinsel, Kedah Peak, 11.–27. iii. Type ♂♀: London.

♂. Länge 11·5–17 mm. Fühler 3·2–6 mm.; Flügellänge 7–15·5 mm., -breite 2·6–4·4 mm.

♀. Länge 13–14 mm. Fühler 4 mm.; Flügellänge 10 mm., -breite 3·7 mm.

♂. Kopf rotbraun, Untergesicht rotgelb, goldgelb tomentiert, Kiel unten mit schwarzem Fleck. Sammetmakeln klein. Stirn mit wenigen Furchen. Rüssel ca. 2 mal kopflang, rostbraun. Fühler lang, schlank. 1. Glied ca. 5 mal so lang wie breit; 2. ca. 1½ mal das 1.; 3. fast so lang wie das 2. Endgriffel 3-gliedrig, ohne Seitenfortsatz, mit langer Endborste. Hinterkopf oben rotbraun, unten gelb, gelbschillernd, auch quer über die Scheitelblase. Thorax rostbraun mit schwarzer, glanzloser Platte und gelblichem bis goldgelbem Reif. Schildchen rotbraun, Pleuren rotbraun oder schwarzfleckig. Flügel hyalin mit brauner Vorderrandbinde bis r_3 resp. *vena spuria*. 1. Hinterrandzelle nur mit hellem Spitzenfleck. 1. Basalzelle ganz hell. *p* hellrotbraun, weiss bereift. Tarsen schwarz, *t* goldschimmernd. Klauen und Haftläppchen weissgelb. Schwinger gelb. Hinterleib schwarz, fast glanzlos, 6. Ring mit rötlichem Hauch. 1.–5. Tergit mit klarer, goldgelber Hinterrandbinde; 6. mit dunklem Vorderrand, sonst goldtomentiert. Genitalien rötlich.

Das ♀ gleicht in allem dem ♂. 3. Fühlerglied oft düster rotbraun schimmernd. Flügelbinde blasser. Schildchen dunkler. *t* mehr weissschimmernd. 3. und 4. Tergit sammetschwarz, ohne Seidenbinde. Theka gelbbraun, desgleichen grosse Teile des 6. und 7. Segments, die mattgelblich bestäubt sind. 1 ♀ hat das 2. und 3. Tergit unbestimmt rotgelb gefleckt.

Conops curtirostris Krb., die ich im Archiv Natg. 81 A, 7, p. 53 (1915), als *celebensis* de Meij. beschrieb, ist doch eine eigene Art. Die dort gegebene Beschreibung gilt also für sie.

Conops celebensis de Meij. ist eine eigne Art, von der der Autor nicht angibt, ob sie Ozellen trägt. Sie muss meiner *C. microvalvus* sehr nahe stehen, die aber ein echter *Physoconops* ist.

Conops selangorensis, n. sp., ♂, von Bukit Kutu, 13. iii. Type: London.

Länge 7·5 mm. Fühler 2 mm.; Flügellänge 6 mm., -breite 2 mm.

Untergesicht gelbbraun, gelbschillernd, Gruben und Kiel schwarz. Stirn und Scheitel schwarz, an der Grenze die schwarzen Sammetmakeln. Rüssel kopflang, schwarz: Fühler lang; 1. Glied ca. 5 mal so lang wie breit, hellrotgelb; 2. ca. $\frac{1}{3}$ länger als das 1., dunkelrostrot; 3. gleich dem 1., schwarz. Seitenfortsatz ziemlich lang, stumpf, Endglied lang, sehr zugespitzt. Thorax, Schildchen, Hinterrücken matt schwarz. Nur zwischen den Schulterbeulen und an den Pleuren etwas weisslich bereift. *p* und Vorderhüften gelbbraun, letztere stark gelbschimmernd, die andern Hüften schwarz. Tarsen braun. Klauen und Haftläppchen bräunlich. Schwinger gelb. Flügel wie bei *C. strigatus* Wied.; etwas bräunlich tingiert, vom Vorderrand bis zur r_3 dunkelbraun. 1. Basalzelle und Raum hinter der *vena spuria* vollkommen hell. Hinterleib glanzlos, schwarz, sehr schlank. 2.–5. Tergit mit goldgelbem, feinem Hinterrandsaum, 6. mit goldgelbem Tomentfleck. Analsegment etwas bräunlich glänzend.

Conops erythrocephala F. liegt vor von Ceylon und N. China.

Conops annulosus Big., ♂♀, Paratypen von Simla.

♂. Länge 10 mm. Fühler 3 mm.; Flügellänge 8 mm., breite 3 mm.

♀. Länge 8 mm. Fühler 3 mm.; Flügellänge fast 9 mm., -breite 3 mm.

♂. Untergesicht rotgelb, satt goldgelb bestäubt. Am Augenrand 2 winzig kleine schwarze Sammetmakeln, die besonders hellgoldgelb umrahmt sind. Stirn braunrot, leicht gefurcht. Scheitelblase bernsteingelb, ohne Ozellen. Hinterkopf schwarzbraun, oben über die Scheitelblase weg und am Auge breit goldgelb schimmernd. Hufeisenfleck angedeutet. Rüssel 2 mal kopflang, schwarz. Fühler schwarz. 1. Glied ca. 4 mal länger als breit; 2. ca. 1½ so lang wie das 1.; 3. so lang wie das 1. Endgriffel 3-gliedrig, fast ohne Seitenfortsatz. Thorax mattschwarz, wenig goldgelb bestäubt. Schulterbeulen rotbraun, der Raum zwischen ihnen goldgelb tomentiert. Pleuren schwarz, grauschimmernd. Schüppchen und Schwinger rotgelb. *p* rotgelb, Tarsen schwarz, Metatarsen von p_3 rotbraun. Silberschimmer der *p* sehr schwach. Vorderhüften rötlichgelb. Hinterleib tiefschwarz, etwas glänzend. 1.–5. Ring mit breitem, parallelrandigem, goldgelbem Hinterrandsaum. 6. Ring fast ganz goldgelb, nur vorn schmal schwarz glänzend. Flügel etwas bräunlich hyalin mit rein brauner Strieme bis r_3 und *vena spuria*. Beide Basalzellen, Discalzelle und eine grosse Partie in der Spitze der 1. Hinterrandzelle heller.

♀. Gleicht in allem dem ♂, aber der Hinterleib ist vorherrschend schwarz: die gelben Binden sind viel schmäler. 5. und 6. Tergit fast ganz gelb tomentiert. Flügelfärbung schwächer. Analsegment schwarz, z. T. gelb tomentiert. Theka schwarz, gross, dornförmig, weiter vorstehend als die Hinterleibspitze.

Neobrachyglossum obscuripennis var. *nigrita* Krb. von Johore, Mt. Ophir, 12. viii.

Physoconops borneensis, n. sp., ♂, von Br. N. Borneo. Kinabalu Kabayan, 9. v. Type: London.

Länge 11 mm. Fühler fast 3 mm.; Flügellänge 6 mm., -breite 1·5 mm.

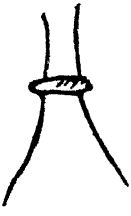
Eine äusserst schlanke Art. Kopf dunkelgelbbraun. Stirnmitte verdunkelt. Der Hufeisenfleck nur angedeutet. Kiel unten mit schwarzem Fleck. Scheitelblase dunkelrotbraun. Rüssel dünn, zweimal kopflang, rotbraun.

Fühler düster rotbraun. 1. Glied ca. 3 mal so lang wie breit; 2. doppelt so lang wie das 1.; 3. etwas länger als das 1. Seitenfortsatz klein und zart. ca. halb so lang wie das Endstück. Hinterkopf schwarz, am Auge zart gelb tomentiert. Thorax mattschwarz. Schulterbeulen gross, gelbbraun, innerhalb gleich den Seitenplatten des Hinterrückens gelb tomentiert. Pleuren ohne Schillerstrieme. *p* dunkel gelbbraun, Tarsen gegen das Ende zu verdunkelt. *t* silberglänzend. Vorderhüften gelbbraun, die andern braunschwarz. Schwinger dunkelrotgelb, der Stiel braun. Flügel brauntingiert. Vorderrand bis einschliesslich r_3 und 1. Hinterrandzelle bis unter die *vena spuria* dunkelbraun. 1. Basalzelle ganz hyalin. Hinterleib schwarzbraun, äusserst dünn gestielt, die gestielte Partie länger als der ganze Rest. 5. Tergit mit weisslichem Reif.

Physoconops microvalvus Krb., 29 Ex. von Java, Soekaboem, Preanger ii.–ix., Djampang, Tenggale, Mt. Gade.

Sollte es sich herausstellen, dass *Physocephala* (*Conops*) *celebensis* de Meij. in diese Gattung gehört, so dürften beide Arten identisch sein und *microvalvus* müsste Synonym werden.

Fig. 30.



Pseudophysocephala abnorma, n. sp. Grenze von Tergit 2 und 3.

Pseudophysocephala abnorma, n. sp., ♂, von Selangor, Bu Kit, Kutu, 3300–3500 ft., 18. iii. Type: London.

Die erste Art aus der orientalischen Region! Kopf gross, dunkelbraungelb, glanzlos. Gesichtsgruben und Kiel schwarz. Rüssel zweimal kopflang, rotbraun, am Ende schwarz. Stirn nur am Rand braungelb, sonst schwärzlich; an den Fühlern steigt die dunkle Farbe tief herunter. Scheitelblase dunkelrotbraun. Hinterkopf schwarz, mit Silberschiller. Thorax schwarz, glanzlos. Schulterbeulen, Brustseiten, Seitenplatten des Hinterrückens grauschimmernd. Abdomen schwarz. 2. Tergit und Basis des 3. seitlich dunkelrotbraun. 2. Ring länger als der 3. 1. breit und kurz. 2. fast parallelrandig, am Ende erweitert. Aus ihm kommt der schmäler beginnende 3. Ring hervor. 4. und 5. seitlich weissschimmernd. Analsegment düsterrotbraun. *p* desgleichen, *t* z. T. weissbereift. Haftläppchen bräunlich, Klauen schwarzbraun. Schwinger rotgelb mit braunschwarzem Stiel. Flügel hyalin, stark irisierend. Binde reicht bis r_3. 1. Basalzelle mit bräunlichem Basalfleck. 1. Hinterrandzelle bis zur *vena spuria* schwarzbraun, hinter derselben absolut hyalin.

PHYSOCEPHALA Schin.

Diese Gattung ist nur z. T. einwandfrei durchgearbeitet. Die von Brunetti aufgestellten bezw. neubeschriebenen Arten haben insofern wenig Wert, als alle von ihm in die Bestimmungstabelle aufgenommenen Merkmale in einzelnen Tieren bezw. Varietäten nicht vorkommen. Jede Art müsste also eigentlich zweimal in der Tabelle auftreten. Beispielsweise soll nach der Tabelle die Vorderrandzelle des Flügels bei *P. bicolorata*, *aurantiaca*, *nigrofasciata*, *rufescens*, *nursei* und *argentifera* bis zum Ende der 3. Ader reichen. Mir liegen *nursei* und *argentifera* vor, bei denen sie weit vor der Flügelspitze abbricht. Ein Ex. trägt an der Mündung der 3. Ader eine braune Makel. Auch nach seiner Zeichnung kommt *nursei* in die Gruppe mit abgebrochener Binde, desgleichen *aurantiaca*.

P. munda, *atricornis*, *annulifera*, *diffusa*, *calopa* und *tenella* haben eine abgebrochene Flügelbinde. Von allen wäre *calopa* stets an Thorax- und Flügelfarbe wirklich erkennbar. Von den andern Arten liegen mir z. Z. vor *diffusa* und *tenella*. Beide sollen die 4. und 5. Längsader gesäumt haben. Nach Brunetti's Zeichnung kommt *diffusa* vor mit braunem Unterrand bis zur Flügelspitze oder mit hellem Fleck vor der letzteren. Und nach Brunetti's Zeichnung kommt *tenella* mit und ohne gesäumte 4. und 5. Längsader vor. Demnach sind diese Arten nach Brunetti's Tabellen nicht bestimmbar. *tenella* liegt mir in 3 Ex. vor :

1 ♀ mit fast hyaliner Vorderrandzelle, ohne Wisch an der 4. oder 5. Ader! 1 ♂, 1 ♀ mit brauner Vorderrandzelle, davon 1 Ex. mit Wisch an der 4. und 5. Ader, 1 Ex. ohne!

Ich versuche also, die mir vorliegenden Tiere so gut es geht in die beschriebenen Arten einzureihen und in die Bestimmungstabellen einzuordnen, verzichte auf jede Neubeschreibung, wenn nicht ganz typische Merkmale vorliegen und warte eine spätere Zeit ab, wenn ein genüzend reiches Material aus möglichst vielen Teilen der orientalischen Region vorliegt. Ich vermute, dass diverse palaearktische Formen bis in die orientalische Fauna bereits vorgestossen sind und vielleicht schon eigene Formen oder Rassen gebildet haben, weshalb bei Bestimmungen die palaearktischen Arten der Nachbargebiete herangezogen werden sollten.

Ich gebe jetzt Erganzungen zu den beschriebenen Arten aus dem mir vorliegenden Typenmaterial des Londoner Museums nach Bestimmungen Brunetti's. Mir liegen Dutzende von Einzelstücken vor, die zu keiner Beschreibung oder Type passen und die wohl besser unbeschrieben bleiben!

Physocephala calopa Big., ♀.

Thorax ganz rostrot, eventuell mit 3 zusammengeflossenen Striemen. Stirn und Scheitel ohne jeden dunklen Punkt. *p* ganz rotgelb. Pleuren mit breiter Schillerstrieme. Flügel absolut hyalin. Die braune Vorderrandbinde ist abgebrochen, wird scharf begrenzt durch die *vena spuria*. Untergesicht ganz rotgelb. Theka rotgelb.

Physocephala argentifera Brun., ♂♀. Paratypen von Chapra, Bengalen.

♀. Thorax rotbraun, eventuell mit schwarzer Mittelstrieme. Hinterrücken unten schwarz. Der Schiller ist m. E. durchaus blassgelb! nicht silberweiss. 3.–5. Tergit in der Mitte vor der goldgelben Binde ±schwarzbraun. Theka hellrotgelb. Vorderrandzelle hell. Binde blassbraun, abgebrochen, bis r_3 und *vena spuria*. Am Ende von r_3 ein ganz blasser Fleck; vor der Analzelle ein ±deutlicher brauner Wisch.

♂. Vorderrandzelle braun! Thorax total voll Grünspan, keine Striemung erkennbar. Discalzelle und 3. Hinterrandzelle zart bräunlich. Hinterleib hellrotgelb,

2. Tergit vorn und hinten silberschillernd, wie beim ♂, die andern goldtomentiert. Toment am Hinterkopf gelb. Ich bezweifle, dass beide Tiere zur selben Art gehören.

Physocephala nursei Brun., ♂, Paratype von N.W. India, Quetta.

Thorax mit 3 zusammengeflossenen Striemen. Pleuralstrieme weiss, nicht goldgelb. Schildchen ganz rostrot, weiss bestaubt. Hinterrücken oben und seitlich dick weiss bestaubt. Thorax vor dem Schildchen ein weisser Querfleck. Brustseiten unten nebst Hüften glänzend schwarz. Kopf ganz gelb, glanzlos, ohne jede braune Makel. Fühler eigentlich schwarz, 1. Glied etwas bräunlich. Vorderrandzelle klar, Ende von r_3 mit Makel.

Physocephala atricornis Brun., ♂, Lahore, Pundschab. Type: London.

Gruppe *pusilla*, mit ganz unscharfem Spitzenfleck. Hat grosse Aehnlichkeit mit *P. persica*.

1. Fühlerglied der Type rotgelb, ca. $2\frac{1}{2}$ mal so lang wie breit. Kopf glanzlos dunkelgelbrot. Gesichtsgruben und Scheitelblase weissgelb, ohne schwarzen Fleck. Rüssel dünn, ca. $1\frac{1}{2}$ mal kopflang, rotbraun. Hinterkopf oben schwarzbraun, unten gelb, am Augenrand breit silberglänzend. Thorax mattschwarz, Schulterbeulen und Partie vor dem Schildchen dicht matt weissgelb tomentiert. Schildchen und Hinterrücken rotbraun, Seitenplatten weissgelb. Pleuren mit breiter Schillerstrieme, Hüften schwarzbraun. p hell rotgelb, f_3 mit dunkelbraunem Band, t_3 mit schwarzbrauner Spitzenhälfte. Tarsen braun, Metatarsen fast gelbbraun. Binde vom Vorderrand bis r_3 und in der Basis der 1. Hinterrandzelle bis zur *vena spuria* reichend. Hinterleib braunschwarz, Grenze der Tergite 2 und 3 gelbbräunlich. Endsegment ±rotbraun. Toment bleichgelb am Hinterrand von Tergit 2 und 3, 4. grösstenteils, 5. und 6. ganz. Genitalien schwarzbraun.

Physocephala diffusa Brun., ♂, Paratype ohne Fundort: London.

Stirnmitte ±unbestimmt rotgelb, die Seiten bis unterhalb der Fühler braun. Vor dem Scheitel ein kleiner brauner Punkt. Thorax grösstenteils dunkelrotbraun. mit 3 zusammengeflossenen, schwarzen Striemen. Schildchen und Pleuren rotbraun. Hinterrücken tiefschwarz. oben und seitlich gelb tomentiert. 1.–3. Tergit ganz rostrot, der Rest schwarzbraun, aber dicht weisslich tomentiert. *p* ganz rotgelb. Costalzelle m. E. etwa so dunkel wie die Binde. Raum unterhalb der *vena spuria* dunkelbraun. Discalzelle der Länge nach braun gesäumt. desgleichen der Raum vor der Analzelle.—Ich halte sie für keine gute Art.

Physocephala tenella Big. (von Brun. nach Type neubeschrieben). 1 ♀ von Quetta. Schwarzes 3. Fühlerglied. Vorderrandzelle hell. Binde bis zur Spitze der r_3. Thorax ganz tiefschwarz. Discalzelle fein bräunlich gesaumt. Kopf ganz gelb, ohne braunen Fleck. *p* ganz gelbbraun. f_3 kaum mit einer Spur von einem schwarzbraunen Ring. 1 ♀ von Singapur.

1 ♂ von Simla, Kangra Valley, ii., mit schwarzbraunen Stirnseiten, die je ein Dreieck bilden, das vom Auge haarfein entfernt bleibt. Gruben mit schwarzem Fleck. Vor der Scheitelblase ein schwarzbrauner Punkt. Flügelbinde bis zum Ende von r_3 reichend, aber vorher etwas aufgehellt. Vorderrandzelle braun. f_3 mit dunkelbraunem Ring. Abdomen von der Mitte des 3. Tergits ab schwarz, mit blassgelben Hinterrandsäumen. Das ♀ von Singapur gleicht dem ♂. aber 2. Tergit nur am Ende rotgelb, sonst schwarzbraun. 3. oben nur mit schmalem, gelbem Vorderrand, der sich seitlich stark verbreitert und das ganze Sternit ausfüllt. Analsegment rostrot. Theka dunkelrotbraun.

Physocephala rufescens Brun., ♂♀, von Kashmir. Paratype: London.

♀. Länge 11·5 mm. Fühler fast 2 mm.; Flügellänge 8 mm., -breite 3 mm.

♂. Länge 9·5 mm. Fühler fast 1·5 mm.; Flügellänge 6 mm., -breite 2·5 mm.

♀. Vorderrandzelle hell. Pleure mit Strieme. Kopf gelbbraun, ohne jede dunkle Makel, ohne Schiller. Fühler rotgelb. 1. Glied ca. doppelt so lang wie breit; 2. ca $2\frac{1}{2}$ mal so lang wie das 1.; 3 gleich dem 1. Griffel 2-gliedrig, sehr kurz. Hinterkopf schwarz, am Auge silberglänzend.

Rüssel dünn, ca. 2 mal kopflang, rostbraun, die Enden schwarz. Thorax, Schildchen, Pleuren hellrotbraun. Thoraxmitte tiefschwarz, glanzlos. Hüften, Hinterrücken schwarz. Schulterbeulen, Pleuralstrieme, Seitenplatten des Hinterrückens, ein Fleck vor dem Schildchen dunkelgoldgelb tomentiert. *p* hellrotgelb, einschliesslich Tarsen. Klauenspitze schwarz. *t* mit Silberglanz. Schwinger dunkelgelb; Schüppchen weisslich. Flügel hyalin. Die Binde reicht von r_1–r_4. Unterrandzelle vor der Spitze etwas graulich aufgehellt. 1. und 2. Basalzelle braun. 1. Hinterrandzelle bis zur *vena spuria*, Discalzelle unten der Länge nach braun. Spitzenfleck über die 3. Längsader hinausreichend. Vor der Analzelle ein brauner Schweif. Hinterleib rostrot, goldgelb tomentiert. Zweite Hälfte des 3. Tergits bis zum 5. einschliesslich schwarz, der Rest rostrot. 1. und 2. Tergit in der Mitte etwas verdunkelt. 1.–5. mit kräftigem, gelbem Hinterrandsaum. 6. ganz gelbtomentiert. Genitalien dunkelrostrot, stark glänzend. Theka rostbraun.

♂ gleicht dem ♀. Stirn mit Spur einer braunen Strieme. Thorax mit 3 getrennten Striemen. Vor dem Schildchen ein grosser rostbrauner Fleck, dem aber das gelbe Toment fehlt. Alles andre wie beim ♀.

Physocephala munda Brun., ♂♀, von Quetta.

Länge ca. 11 mm. Fühler 2 mm.; Flügellänge 6 mm., -breite ca. 2·1 mm.

♂. Kopf warm rotgelb, glanzlos, nur der untere Augenrand silbern. Gruben heller. Rüssel, Fühler hellrotgelb. 1. Glied ca. 4 mal so lang wie breit, 2. ca 1½ mal so lang wie das 1., 3. kürzer als das 1. Endgriffel fehlt. Hinterkopf rotgelb, mit goldgelbem Toment. Der ganze Körper warm rotgelb, goldgelb tomentiert. Pleuren mit breiter Strieme. *p* ganz hell rotgelb. Flügel absolut hyalin. Eine bräunliche Strieme zwischen r_2 und r_3 bis zum Ende der 1. Längsader, wo sie tatsächlich verschwindet. 1. Längsader und die Basis verschiedener anderer rötlichgelb, die andern braun.

♀ gleicht dem ♂, aber der Schiller ist durchaus weisslich. Thorax vorn mit 2 rötlich braunen Längsstriemen bis zur Quernaht. Theka so lang wie die Hinterleibspitze, unten schwarz.

Varietät, ♂♀.

♂. Die Flügelbinde verschwindet schon vor dem Ende der 1. Längsader. Aller Schiller bleichgelb. Thorax und Hinterleib im Grunde wohl schwarz, aber dicht goldgelb tomentiert, daher merkwürdig weissgraulich erscheinend.

♀. Aller Schiller weisslich. Thorax mit einer breiteren, rostbraunen Mittelstrieme, die aber nur ganz vorne deutlich ist. Die Flügelbinde ist viel deutlicher und bricht plötzlich am Ende der 1. Hinterrandzelle ab. Vorderrandzelle absolut hyalin.

Physocephala bipartita Dol., von Siam, Bulsit Besar, Penang Ins., x.

Physocephala ammophiliformis Krb., ♀, von Bébé Bez., Chung King, Szetschwan, 30. vi. Type ♀: Dahlem.

Länge 20 mm. Fühler 4 mm.; Flügellänge 13 mm., -breite über 4 mm.

Eine grosse reinschwarze und dunkelbraun gezeichnete Form mit schwarzen Haftläppchen. Das ♀ ist wohl feucht gewesen, hat nur Spuren von Toment aufzuweisen. Stirn flach ausgehöhlt, ohne jede Furche. Von dieser Delle hebt sich die Scheitelblase mit scharfem Rand ab. Rüssel 1½ mal kopflang, Fühler fast ganz schwarz. 1. Glied ca. 3–4 mal so lang wie breit; 2. ca. 3 mal so lang wie das 1.; 3. ca. so lang wie das 1. Griffel 3-teilig, Seitenfortsatz rechtwinklig abgespreizt. 1. und 2. Fühlerglied unten und an der Spitze aufgehellt. Haftläppchen und Klauen schwarz. Hinterleib robuster als beim ♂. 1. Ring schwarz, 2. dunkelrotbraun, so lang wie der 3.–5. Analsegment und Theka schwarz, glänzend. Theka vorn düster rotbraun, der Rand fast gelbbraun, breit schuppenförmig, wenig weiter vorstehend als die Abdominalspitze. Vorderrandzelle etwas heller braun als die Binde. Unterrandzelle ohne Aufhellung.

Physocephala paralleliventris, n. sp., ♀, von N. Borneo, Bettotan, 31. viii., Travancore, 6.–10. v. (Thekkedi, Periyar Dam), Kubat, 18. ix.

Länge 6–9 mm. Fühler ca. 2 mm.; Flügellänge 4–6 mm., -breite 1·4 mm.

Unverkennbar an dem eigentümlich gestalteten Hinterleib. Vielleicht Vertreter einer eigenen Gattung. Während bei allen Arten der 2. Ring an Dicke zunimmt und unmerklich in den 3. übergeht, sind hier die Seiten des 2. Tergits parallel und der dritte Ring beginnt sogleich sich seitlich auszubauchen. 3.–5. Ring eine fast parallelwandige Keule bildend.

Kopf glanzlos, dunkelgelbbraun, am Augenrand etwas silberglänzend. Stirnmitte dunkelbraun, unscharf begrenzt. Gruben und Kiel schwarz glänzend. Rüssel verhältnis mässig dünn, 2 mal kopflang, rotbraun, an der Basis schwarz. Scheitelblase zart abstehend schwarzbraun behaart, an der Spitze schwärzlich verdunkelt, mit seichter Delle. Fühler schwarz, 1. Glied an der Spitze rotgelblich. 1. ca. 3 mal so lang wie breit, 2. ca. $2\frac{1}{2}$ mal so lang wie das 1. ; 3. gleich dem 1., kurz kegelig. Endgriffel und Seitenfortsatz gleich lang, beide kurz und dick. Hinterkopf schwarz, am Augenrand silberglänzend. Thorax, Schildchen, Hinterrücken schwarz, Schulterbeulen rostrot. Pleuren düster rotbraun mit Silberstrieme. Hinterrücken oben und seitlich graugelblich schimmernd. p rotbraun, p_1 am hellsten, t-basen oder t grösstenteils gelblich ; t_1 silberglänzend. Tarsen nach dem Ende zu verdunkelt. Schwinger rotgelb, Stielbasis dunkel. Flügel hyalin, sehr stark irisierend. Vorderrandbinde schwarzbraun, vom Vorderrand bis zur r_3 und in der 1. Hinterrandzelle bis zur *vena spuria*. Spitze der Unterrandzelle aufgehellt. Stiel der kurzen Hinterrandzelle ziemlich stark nach vorn geneigt. Hinterleib fast schwarz, glanzlos. 2. Ring so lang wie der 3., aber nur $\frac{1}{3}$ so breit. 3. mit haarfeinem, graugelbem Hinterrandsaum, der sich seitlich stark verbreitert. 4. halb so lang wie der 3., mit breiter, graugelber Hinterrandbinde. 5. schmal, schwarz. 6. und 7. grösstenteils graugelb tomentiert. Theka braun, etwas länger als die Analspitze. Abdomen gegen das Ende zu ziemlich dicht und lang abstehend behaart (etwa von der Mitte des 3. Ringes ab).

Das ♀ von Travancore ist entschieden heller gefärbt Stirn ganz gelbbraun 1. Fühlerglied und Unterseite de. 2. ±hellgelbbraun. Thorax hell rostrot gerandet. Schilds chen und Pleuren rostrot. p heller, t fast ganz gelbbraun 2. Tergit fast ganz rostrot. Analsegment hell rostrot.

Physocephala gigas Macq., 3 ♀♀, 2 ♂♂, von Java, Soekaboemi, v.–vi., Preanger (Djampang, iv.).

Myopa nigriventris Brun., ♂, von Kashmir. Paratype: London.

Gehört in die Gegend von *testacea*, sehr ähnlich *testacea* var. *japonica* Krb.

♂. Länge 7 mm. Untergesicht und Backen glanzlos gelbbraun, sehr hell. Bart weiss. Am Augenrand unterhalb der Fühlerhöhe eine braune, unregelmässige Makel, etwas höher, genau neben den Fühlern, eine zweite, dunklere. Scheitel mit Λ-förmiger, dunkelbrauner Zeichnung, die das lange, gelbe, glänzende Dreieck in sich schliesst. Rüssel lang, dünn. Taster lang, fädlich, braun. Hinterkopf oben rotbraun, unten gelblich. Kopfbehaarung fast schwarz. Fühler einschliesslich Borste rotgelb. 1. Glied breiter als lang, sehr klein; 2. ca. 1½ mal so lang wie vorn breit. Beide dicht und stark schwarz behaart, daher sehr dunkel erscheinend. 3. kleiner als das 2., am Grunde weisslich bereift, rotgelb. Borste gelblich, an der Spitze braun. Der ganze Thorax schokoladebraun mit tiefschwarzer matter Platte und Schildchen und mit glänzend schwarzem Hinterrücken. *f* kastanienbraun mit schwarzem Ring vor der Spitze. *t* etwas heller mit 2 schwarzen Ringen. Tarsen nebst Haftläppchen und Klauen hellbraun; Klauenspitzen schwarz. Flügel bräunlich, Adern dick, schwarz; hintere Querader wohl etwas stärker, aber nicht gesäumt. Schüppchen weiss. Schwinger rotgelb. Hinterleib tiefschwarz, stark glänzend, schwarz behaart. 2. Ring mit etwas weissgrauem Schiller. Genitalien und Bauch rotbraun.

Myopa picta, ♂, von Quetta, 2 ♂♂.

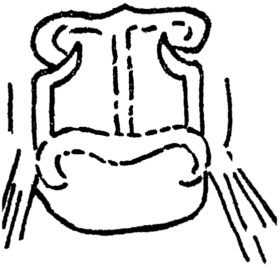
Myopa curta Krb., 2 ♂♂, von N. Kumaon, Indien.

Melanosoma bella Krb., von Indien, Ferozepore, Nurse.

Occemyia flavipes Brun., 1 Ex. von Bombay, Malea.

Die Fühler fehlen. Stirn bis zum schwarzen Scheitel leuchtend rotgelb, an den Augen schmal silbern. Scheitelblase glänzend rotbraun. Hinterkopf oben breit glänzend schwarz, unten weiss. Untergesicht weissgelb, silberglänzend. Rückenschild mit dunkler glänzender Mittelstrieme, die beiderseits breit graulich eingefasst ist. Hinter den Beulen liegt je ein winklig gebogener Streifen, vor dem Schildchen ein Querstreifen. Schulterbeulen weiss tomentiert. Schildchen, Hinterrücken, Pleuren schwärzlich. Schwinger rotgelb, Flügel bräunlich, mit braunen Adern, im Basalteil mit gelblichen. Stark irisierend. 1. und 2. Tergit bräunlich; 3.–6. schwarz; 2.–4. mit ziemlich klarer, grauweisser Hinterrandbinde. Analsegment glänzend schwarz. *p* inclusive Vorderhüften hellrotgelb. *f*-spitzen etwas bräunlich. *t* und Tarsen braun.

Fig. 31.



Occemyia flavipes Brun. Thorax zeichnung.

Sicus ferrugineus L., von Kaschmir, Gulmarg.

Sicus indicus F., 1 ♂, vom Himalaya. Museum Berlin.

Ich möchte dieses Tier als die bisher nicht wieder aufgefundene Fabricius'sche Art ansprechen.

Länge 12 mm. Fühler fast 1 mm.; Flügellänge 8 mm., -breite 3·5 mm.

Grosse, robuste Art, Stirn dunkelgelb, Scheitel mehr rotgelb. Ozellenfleck schwärzlich, hell umrandet. Untergesicht rotbraun. Gesichtsgruben gelblich glänzend. Backen mit goldgelbem Schiller. Fühler hellrotgelb mit schwarzer Borste, die länger ist als das 3. Glied. Rüssel schwarz. Hinterkopf rotbraun, schwarz behaart. Thorax rotbraun, oben matt schwarz, mit weisslichem Schimmer. *p* rotbraun, Tarsen rotgelb, Haftläppchen gelblich. Klauen rotbraun mit schwarzer Spitze. Schüppchen weisslich, weiss behaart. Schwinger rotgelb. Schildchen rotbraun. Hinterrücken tief schwarz. Hinterleib hell rotbraun, stark glänzend. 1. Tergit schwarz. 3.–5. mit gelblicher Schillerstrieme am Vorderrand, die ziemlich auffällt.

Stylogaster orientalis Brun., ♂, von Pundaluoya, Ceylon. Paratype: London.

Index to new Genera and Species described in Kröber's "Beiträge zur Kenntnis der Conopiden."

abnorma, (11) v. p. 235.
affinis, (11) iv. p. 532.
annulipes, (11) iv. p. 389.
antennatus, (11) v. p. 69.
ARCHICONOPS, (11) iv. p. 381.
atrimanus (var.), (11) iv. p. 379.

borneensis, (11) v. p. 234.
brasiliensis, (11) iv. p. 535.
brunnicornis, (11) v. p. 78.

cænoneura, (11) iv. p. 385.
CALLOSICONOPS, (11) v. p. 75.
camaronensis, (11) iv. p. 380.
CHRYSIDIOMYIA, (11) v. p. 73.
curticornis, (11) v. p. 69.

DELKESKAMPOMYIA, (11) v. p. 71.

fasciata, (11) v. p. 71.
fenestralis, (11) iv. p. 386.
flavonervosus, (11) iv. p. 366.
frontosa, (11) v. p. 225.

grisescens, (11) iv. p. 537.

hirsutus, (11) v. p. 75.
hirta, (11) iv. p. 384.

japonicus, (11) iv. p. 367.

malayensis, (11) v. p. 232.
de meijerei (var.), (11) iv. p. 599.
MICROBRACHYCERÆA, (11) v. p. 226.
minutus, (11) v. p. 67.

niger (Archiconops), (11) iv. p. 381.
niger (Senoconops), (11) iv. p. 606.
nigricans (var.), (11) iv. p. 370.
nigrifacies, (11) v. p. 66.
nigritarsis, (11) iv. p. 388.
nigrithorax, (11) v. p. 77.

obscura, (11) v. p. 72.
ornata, (11) v. p. 80.

pallidetinctum, (11) iv. p. 531.
papuanus, (11) v. p. 81.
paralleliventris, (11) v. p. 241.
perbellum (Conops), (11) iv. p. 601.
perbellum (Physoconops), (11) iv. p. 467.
pilosum, (11) iv. p. 531.
PSEUDOPHYSOCEPHALA, (11) iv. p. 382.
pulchella, (11) v. p. 74.

robustus, (11) v. p. 66.
rufa, (11) v. p. 73.

selangorensis, (11) v. p. 233.
similis (Microconops), (11) v. p. 79.
similis (Paraconops), (11) v. p. 65.
SMARTIOMYIA, (11) v. p. 72.
STENOCONOPS, (11) iv. p. 606.
stylata, (11) iv. p. 385.
subapicalis, (11) iv. p. 376.

tasmaniensis (Heteroconops), (11) v. p. 68.
tasmaniensis (Microconops), (11) v. p. 79.
thoracicus, (11) iv. p. 587.
triangularis, (11) iv. p. 537.

ugandæ, (11) iv. p. 387.
unicinctus, (11) iv. p. 603.

XVIII.—*Descriptions and Records of Bees.*—CLXXIX.

By T. D. A. Cockerell, University of Colorado.

Halictus vumbensis, sp. n.

♂.—Length about 5·5 mm., anterior wing 4·5.

Black, including clypeus, mandibles, antennæ (flagellum very faintly brownish beneath), tegulæ, and legs; hair of head and thorax thin and long, greyish white; head extremely broad, broader than long; clypeus polished, with scattered punctures; supraclypeal area dull; front dull, a little shining along orbits; vertex dull; antennæ rather short for a male, reaching about to hind part of mesonotum; disc of mesonotum and scutellum polished, the punctures very fine; postscutellum dull, not covered with pale tomentum; area of metathorax somewhat shining, the microscope shows numerous very fine parallel plicæ on a minutely striate ground. Wings dusky, the apical margin a little darker; stigma dark brown, nervures brown; second cubital cell narrow, receiving recurrent nervure well before end; tarsi with shining white hair on inner side. Abdomen rather stout, shining, without hair-bands or spots.

S. Rhodesia: Vumba, Umtali, May 23–26, 1932 (*Alice Mackie*).

By reason of the small size, and black clypeus and legs, this may be compared with *H. windhukensis* Friese, but it is easily distinguished by the very broad head and the relatively short marginal cell. *H. parvulinus* Ckll. has quite different antennæ.

Halictus collegus Cameron.

♂.—Cape Province: Montagu Pass, Nov. 1931 (*Alice Mackie*).

This appears to be *H. collegus*, as it agrees sufficiently with Cameron's description and my notes on the type in British Museum. A noticeable feature is that the anterior tibiæ in front and their tarsi are pale reddish, whereas the hind legs are entirely dark (Cameron says, tarsi for the greater part testaceous). The first recurrent nervure does not meet the intercubitus, as it should according to Cameron. The very long flagellum, red beneath, with the sutures darkened, agrees with the type. The type has much more pale hair on face, but it seems to have been denuded in the specimen before me. The area of metathorax has fine parallel plicæ at sides, but in middle is irregularly more or less reticulate; this agrees well with Cameron's account.

Halictus robertianus Cameron.

♂.—Cape Province: Bot River, Nov. 10, 1933 (*L. Ogilvie*).

Allied to *H. pallidipennis* Smith.

Halictus malachurinus levisculptus (Cockerell).

♂.—Like *H. malachurinus* Ckll., but antennæ entirely dark (clear light red at end beneath in *H. malachurinus*); thorax more robust; tegulæ brown except margin; second cubital cell much broader; tarsi conspicuously red at apex. The mesonotum is entirely dull, and the tergites have hair-bands on apical margins. The hair of face and front is very long and abundant.

S. Rhodesia: Vumba, Umtali, May 23–26, 1932 (*J. Ogilvie*).

This was described from the female; the male is new.

Halictus holostictus, sp. n.

♂.—Length about 8 mm., anterior wing 6·7.

Black, head and thorax with abundant whitish hair, faintly flavescent dorsally; head large and broad, orbits converging below, clypeus produced, with a broad lemon-yellow margin, which is emarginate above in middle; labrum dull yellowish; mandibles pale red except at base; antennæ very long, the stout flagellum dull red beneath; clypeus shining, supraclypeal area dull; front dull, not shining along orbits; mesonotum densely and coarsely punctured, a little glistening; scutellum with two shining but very strongly punctured areas on disc; postcutellum hairy, but without dense tomentum; area of metathorax poorly defined, slightly glistening, coarsely rugose, the microscope shows strong vermiform rugæ, from which little branches project at sides; tegulæ very dark reddish, with pale margins, and a light red mark in front and behind. Wings dusky hyaline; stigma rather small, dull red; nervures brown, the outer ones not weakened, second cubital cell broad, receiving recurrent nervure well before end; third cubital very broad above; femora black; tibiæ yellow at base and apex, and front and hind ones with a stripe running the whole length; tarsi entirely yellow. Abdomen coarsely and closely punctured, first tergite with a transverse subapical elevation, tergites 2 to 5 with basal bands of greyish-white tomentum, but no distinct subapical bands; apex pale brownish.

S. Rhodesia: Vumba, Umtali, May 23–26, 1932 (*L. Ogilvie*).

Superficially similar to *H. postpictus* Ckll., but easily known by the sculpture of thorax and yellow band on clypeus. It is remarkable for the strong punctures.

Halictus durbanensis, sp. n.

♂.—Length about 6 mm., anterior wing 4·5.

Robust, with broad abdomen; head and thorax black, abdomen slightly brownish, the hind margins of the tergites suffusedly brown, and the extreme margins of second to fourth whitish; hair of head and thorax scanty, pale greyish, a band of pale tomentum along hind margin of mesonotum (but not at sides); head broad; mandibles red; upper part of clypeus dull, lower part with a shining eminence on each side and a series of large pits between them; supraclypeal area with a shining prominence in middle; antennæ black; mesonotum dull, very minutely punctured, faintly shining on disc; scutellum with two little shining elevations, close together; area of metathorax large, dull, with an obtuse shining hind margin, the microscope shows fine plicæ on basal half, in the middle irregular and forming a network, the apical half very finely tessellate or minutely reticulate, the whole area under the microscope glistening; posterior truncation dullish; tegulæ pale reddish. Wings hyaline, stigma large, very pale, with dusky margin; nervures practically colourless; second cubital cell broad, receiving recurrent nervure well before end. Legs black at base, but knees, tibiæ, and tarsi bright red; hind spur with spines. Abdomen thinly hairy, but without hair-bands or spots.

Natal: Durban, Oct. 14–18, 1931 (*J. Ogilvie*).

A series of small species with largely red legs may be separated thus:—

	Abdomen mainly or wholly red	1.
	Abdomen black or very dark brownish ...	2.
1.	Abdomen red and black	*ameliæ* Ckll.

Abdomen clear red, with little black ..... *snelli* Ckll. and *rufimentis* Ckll. (the latter with first tergite mainly black).
2. Mesonotum shining .... *nudulus* Vachal.
Mesonotum dull .... 3.
3. More robust; abdomen with broad greyish bands at bases of tergites, stigma red. *capnopus* Vachal.
Less robust; abdomen without such bands, stigma very pale .... *durbanensis* Ckll.

Halictus micropastinus, sp. n.

♂ (type).—Length about 5·5 mm., anterior wing 4·6. Black, the head and thorax with thin greyish-white hair; head broad (width about 1·7 mm.), clypeus little produced, convex, polished, with scattered punctures; mandibles black, faintly reddish apically; supraclypeal area large, dull, strongly contrasting with clypeus; antennæ black, the flagellum sometimes reddened beneath apically; front dull, with a shining line along orbits; mesonotum moderately shining, very finely punctured: scutellum polished on disc; area of metathorax large; approximately semicircular, dull, with the marginal region shining, the microscope shows a minutely tessellate surface, and, except the broad apical margin, with a network of very delicate plicæ; posterior truncation polished; tegulæ very dark brown. Wings dusky, stigma large, pale brown, nervures pale brown; second cubital cell broad, receiving recurrent nervure some distance before end. Legs black, with pale hair, hind spur with three long spines (style of *H. pastinimimus* Ckll.). Abdomen broad, shining, the tergites without any trace of basal hair-bands or spots, but hind margins of tergites 2 to 4 with thin bands of hair; apex not at all reddened.

♂.—Head broad; clypeus entirely black; antennæ short for a male, the flagellum obscurely brownish beneath; mesonotum polished; legs entirely dark; abdomen rather broad, without hair-bands. This male resembles *H. vumbensis* Ckll., but the head is larger and not so short, the thorax and abdomen are more robust, and the margins of the tergites are brownish. The supraclypeal area shows a shining spot, lacking in *H. vumbensis*.

Natal: Drakensburg National Park, March 3–15, 1 ♀, 2 ♂ (*A. Mackie, J. Ogilvie*).

The reference of the males to this species is not quite certain; if *H. vumbensis* had come from the same locality, it might have been chosen as the more probable male. The female is easily distinguished from *H. pastinimimus*

Ckll. and *H. hirtulinus* Ckll. by the sculpture of area of metathorax, and the shape of the area is quite different from that in *H. pastinellus* Ckll. The dull (not polished) supraclypeal area readily separates it from *H. dispositinus* Ckll. and *H. dispositellus* Ckll. Two females from Ficksburg, Orange Free State, Feb. 26 to March 1 (*A. Mackie, J. Ogilvie*) are also referred to *H. micropastinus.*

Two other forms are so closely allied to the above that I had at first regarded them as identical. They may be defined as follows :—

Halictus parapastinus, sp. n.

♀.—Similar to *H. micropastinus* with the same sculpture of area of metathorax and same hind spur, but with head smaller, supraclypeal area polished, lower part of sides of face conspicuously shining. Wings hyaline, faintly reddish, with light red stigma ; area of metathorax with the shining points on margin very close together. Abdomen beyond the second tergite conspicuously hoary with thin pale hair, the hairs long. The mesonotum is dull, somewhat shining on disc, but not at all polished, whereby the species may easily be separated from *H. dispositinus* Ckll. The anterior wing is about 3·7 mm. long.

Natal: Drakensburg National Park, March 3–15, 1 ♀ (*J. Ogilvie*).

Halictus semipastinus, sp. n.

♀.—Similar to *H. micropastinus*, with brown stigma and greyish-hyaline (not at all reddish) wings, but area of metathorax extremely minutely tessellate, wholly without plicæ, except that at sides posteriorly very fine striæ run to the margin ; thorax less robust, the mesonotum conspicuously less shining ; hind margins of tergites conspicuously pallid. The small supraclypeal area is shining, but not the lower part of sides of face. The apical tergites have thin long hairs.

Natal: Drakensburg National Park, March 3–15, 2 ♀ (*J. Ogilvie*).

The three species may be separated by the following abbreviated table :—

	Area of metathorax without plicæ	*semipastinus.*
	Area with well-defined irregular plicæ	1.
1.	Supraclypeal area dull	*micropastinus.*
	Supraclypeal area polished	*parapastinus.*

Halictus rufitarsellus, sp. n.

♀.—Related to *H. semipastinus*, with the area of metathorax large, the surface minutely granular, without plicæ, the hind margin not shining; the scutellum is minutely tessellate, with widely separated very minute punctures. It is distinguished by the following characters: head very broad, distinctly broader than long; mandibles red; clypeus very short, polished; supraclypeal area convex, polished; front and sides of face shining; flagellum bright chestnut-red beneath except at base; mesonotum and scutellum highly polished; area of metathorax entirely dull; tegulæ dark at base, but with a conspicuous red spot on hinder part. Wings dusky, stigma large, very pale brownish; nervures almost colourless, second cubital cell broad below, receiving recurrent nervure well before end. Legs black, with the tarsi light red, the hind basitarsi dusky. Abdomen broad, convex, shining, without hair-bands, but with hind margins of tergites pallid. The abdomen is very like that of *H. semipastinus*, but the broad head and red tarsi are distinctive. It is also related to *H. politifrons* Ckll.

Natal: The Bluff, Durban, Oct. 15, 1931 (*W. P. Cockerell*).

The following table separates some small species found at Durban:—

	Tibiæ and tarsi clear red	*durbanensis* Ckll.
	Tibiæ not red	1.
1.	First two tergites red, marked with black	*dispilurus* Ckll.
	First two tergites not red; tarsi red...........	*rufitarsellus* Ckll.

Halictus hypochlorinus, sp. n.

♀.—Length about 4 mm.

Black, the head and thorax with a very faint greenish tint; hair thin, dull whitish; head moderately broad; clypeus little produced; mandibles and antennæ black; clypeus dullish, supraclypeal area with a shining elevation; front shining; scutellum shining, not bigibbous; area of metathorax rather large, minutely but very distinctly tessellate, with short well-separated plicæ at base only; seen from above, the area has no shining margin, but this can be seen from behind; posterior truncation small, shining; mesonotum shining but not polished, with a delicate median groove, the very minute and widely separated piliferous punctures on a minutely lineolate surface; tegulæ black. Wings dusky hyaline, the stigma and nervures very pale, but the stigma distinctly brownish. Legs black, hind spur with three oblique spines. Abdomen shining, without hair-bands or spots.

S. Rhodesia: Vumba, Umtali, May 23–26, 1932 (*A. Mackie, L. Ogilvie*).

Compared with *H. zimbabuicus* Ckll., it is very much less green, with smaller head and shorter face. It should not, indeed, be classified with the green species, the metallic colour being so faint. *H. lampronotus* Cam. differs by the rather narrow oblong head. There is a good deal of resemblance to *H. epichlorus* Ckll., which is more robust, with a conspicuously longer face, but certainly closely allied. The shining front separates it from *H. umtaliellus* Ckll.

Halictus atricillus, sp. n.

♂.—Length about 4·5 mm., anterior wing 3·3.

Black, including mandibles, clypeus, antennæ, tegulæ, and legs, the antennæ short for a male; abdomen fusiform, shining black, without hair-band or spots; wings ample, dusky hyaline, stigma and nervures pale greyish brown; second cubital cell narrow, receiving recurrent nervure well before end; third cubital about twice as broad on marginal as second; area of metathorax semicircular, with a minutely tessellate surface, and a network of very fine plicæ. Compared with *H. windhukensis* Friese, this is easily distinguished by the broader face and much less produced clypeus; they agree in the shining mesonotum, with a marked central groove, and the black shining tegulæ. Compared with *H. vumbensis* Ckll., which comes from the same locality, this differs by being considerably smaller, with the head much smaller and not so broad; the wings and abdomen are very similar, though the abdomen is narrower.

S. Rhodesia: Vumba, Umtali, May 23–26, 1932 (*Alice Mackie*).

I feel sure that this is not the male of *H. hypochlorinus*; the area of metathorax is different, the supraclypeal area is not polished, and the front is dull seen from in front, though moderately shining seen obliquely from below.

XIX.—*On the First Zoeal Stage of* Dotilla sulcata (*Forskal*).

By M. M. Ramadan, Ph.D. (Cantab.). (From the Zoology Department, Foud's University, Cairo.)

During the summer of 1938, the author collected many crab larvæ at the Biological Station of Foud's University at Ghardaqa, on the Red Sea. An account of these larvæ will be published in course of time, but as the larva of *Dotilla* shows some particularly interesting features, it seems advisable to deal with it separately.

The adults of this species are found in great numbers on the sandy parts of the tidal area. Like the other members of the family (Ocypodidæ), they dig great numbers of small holes in the sand. These holes are particularly obvious below the high-water mark. When the crabs are disturbed, they quickly disappear into them.

A few adults were found with eggs during the first week of September, and these were kept in the laboratory till they hatch their eggs.

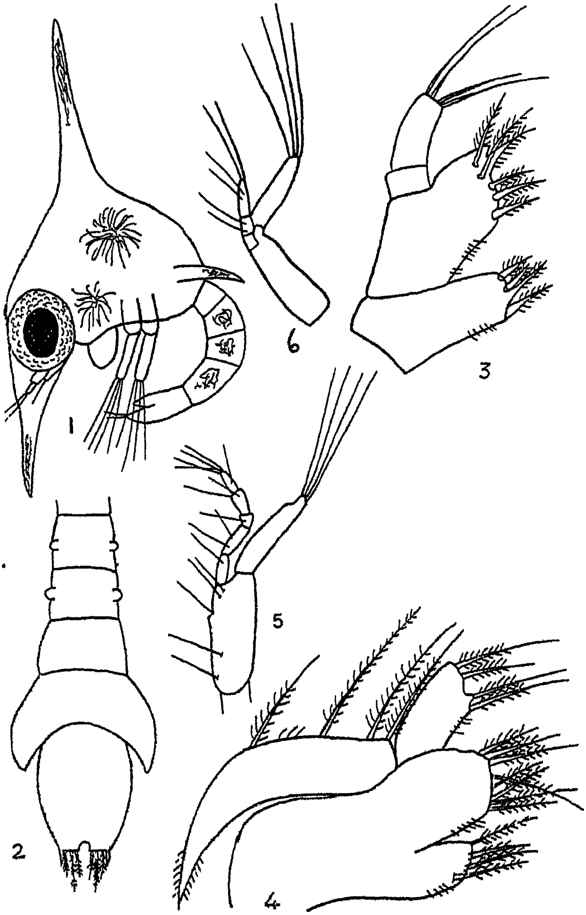
Description of the First Zoea.—Length of the body 1·16 mm. Tip of rostral to tip of dorsal spine 1·22 mm. Distance between two lateral spines 0·70 mm. The larvæ roll themselves into a ball-like shape.

Carapace with very large dorsal and rostral spines, the laterals being much smaller. Abdomen gradually widens in the posterior direction. Abdominal segments 2 and 3, with lateral papillæ. Segment 5 very broad, expanded and produced backwards on either side of the telson. Telson with lateral edges not parallel, posterior edge straight, with a small notch in the middle, with four spines between the edge and median notch; outer spine not plumose and confluent with telson.

Antenna vestigial. Maxilla 1 with endopodite of two segments; segment 1 without a seta, segment 2 with four setæ. Maxilla 2 with both coxopodite and basipodite broad; exopodite with four setæ, proximal lobe ending in a feathered point.

Maxillipede 1, endopod 5-segmented; maxillipede 2, endopod 3-segmented.

Remarks.—The zoea of *Dotilla sulcata* shows striking resemblance to that of the Pinnotherid *Pinnixa* (Faxon, 1878); in the general shape of the body, shape of the 5th abdominal segment and telson, they are almost identical. This expanded form of the 5th abdominal segment is not known to exist in any other genera except *Dotilla*, *Pinnixa* and *Elamena* (fam. Hymenosomatidæ; Gurney, 1938). The striking similarity between the larva of *Dotilla* and *Pinnixa*, though interesting, is not surprising, since the two families Pinnotheridæ and Ocypodidæ are closely related. Gurney (1938), on the strength of the similarity between the larva of *Elamena*



Dotilla sulcata. 1st zoea.

1. Lateral view. 2. Dorsal view of abdomen and telson. 3. 1st maxilla. 4. 2nd maxilla. 5. 1st maxillipede. 6. 2nd maxillipede.

(fam. Hymenosomatidæ) and *Pinnixa* (fam. Pinnotheridæ), believes that the Hymenosomatidæ should be removed from the Oxyrhyncha and placed near the Pinnotheridæ among the Catometopa. The fact that the larva of another member of a Catometope family (Ocypodidæ) shows the same resemblance to the larva of *Elamena*, strongly supports Gurney's view of removing the Hymenosomatidæ to the Catometopa.

REFERENCES.

FAXON, W. 1879. " On some Young Stages in the Development of *Hippa, Porcellana,* and *Pinnixa.*" Bull. Mus. Comp. Zool. Harvard, v. pp. 253–68, 5 pls.

GURNEY, R. 1938. " Notes on some Decapod Crustacea from the Red Sea, vi.–viii. P. Z. S. series B, vol. cviii. pp. 73–84, 6 pls.

XX.—*On Two Tapeworms from a Burmese Snake.*

By F. J. MEGGITT.

THANKS to the courtesy of the Superintendent, Dr. Burgess Barnett, to whom he wishes to express his thanks, the author was given specimens of two species of tapeworms collected at post-mortems on two water snakes [*Homalopsis buccata* (Linnæus, 1766)] from the Victoria Memorial Park, Rangoon. No cestodes have previously been recorded from this host.

Diphyllobothrium sp.

Two larvæ from the musculature of the back. The identification of larvæ of this genus is practically impossible : it is probable that they are *D. reptans* (Diesing, 1850), previously recorded from Burma. The evidence for considering this species as identical with *D. erinacei* (Rudolphi, 1819), to the author does not appear conclusive.

Crepidobothrium nankingensis (Hsü, 1935).

Length 250 *, breadth 2. Scolex absent. Genital pore slightly anterior to centre of margin. Cirrus-sac in proglottides with immature uterine pouches 0·357–0·536 (average 0·5) × 0·129–0·124 (average 0·143), passing vitellaria and excretory vessels. Testes 130–170, 0·057 × 0·05–0·083 × 0·078 (average 0·075 × 0·065) dia. Uterine pouches 30–37 each side. Gravid proglotides absent.

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* All measurements in mm.

This species has only once been recorded, from a snake at Nanking (Hsü, 1935, p. 479). In view of the distance between this locality and Burma, it was considered advisable to supply the above details to establish the close agreement between the two forms.

REFERENCE.

HSU, H. F. (1935). "Contributions à l'étude des cestodes de Chine." Rev. Suisse Zool. xlii. pp. 477–570.

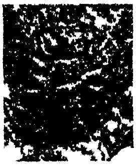
XXI.—*The Food-plant of* Platyauchenia latreillei (*Castelnau*) (Hispinæ, Chrysomelidæ, *Coleoptera*). By S. MAULIK.

IN the 'Proceedings of the Zoological Society of London,' published on the 20th September, 1933, my paper "On the Structure of Hispine Beetles.—III." appeared. Here on page 670 I stated that the food-plant of the above species is "cocoa," being my incorrect translation of the Portuguese word "coqueiro." Again, in my paper entitled "Distributional Correlation between Hispine Beetles and their Host-plants," published on the 15th July, 1937, in the 'Proceedings of the Zoological Society of London,' Series A, on page 133 I stated that the food-plant of the above species is "Cocoa, *Theobroma cacoa* Linn."

These two statements are incorrect. The food-plant is "Coconut, *Cocos nucifera*." I am indebted to Dr. Gregorio Bondar of Bahia, Brazil, for drawing my attention to this error. I take this opportunity of thanking him for his courtesy in allowing me to correct the error.

I am glad of this correction, because it is in conformity with the general conclusions arrived at concerning the food-plants of Hispinæ as a whole. The food-plant "cocoa" for a hispine beetle is an anomaly which had to be explained somehow, but not very satisfactorily.

On page 131 of the "Distributional Correlation" paper I stated the following: "Some thirteen species of Hispinæ have been found on the Coconut-palm all from the Old World, and none has yet been reported from the New World." The consequence of this correction is that at least one New World species has been found on the widely distributed cultivated Coconut-palm. Probably others will also be found



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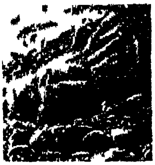

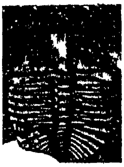

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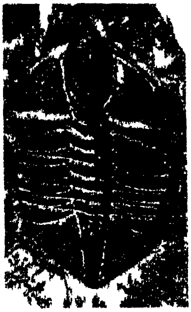

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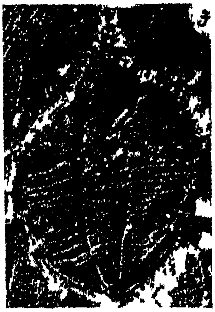

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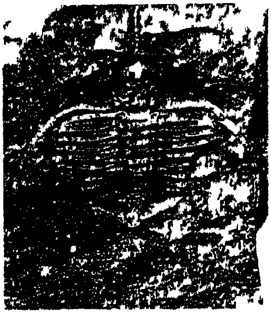

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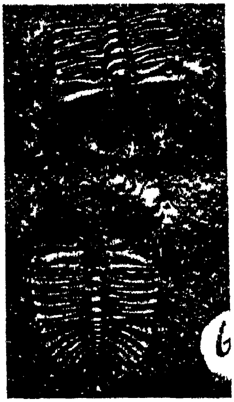

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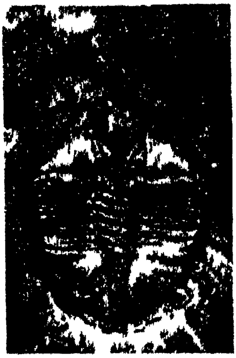

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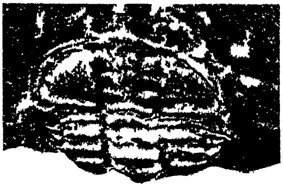
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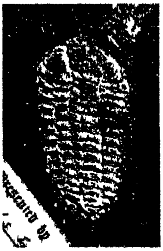
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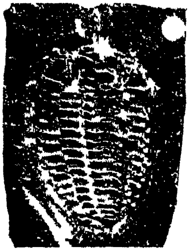
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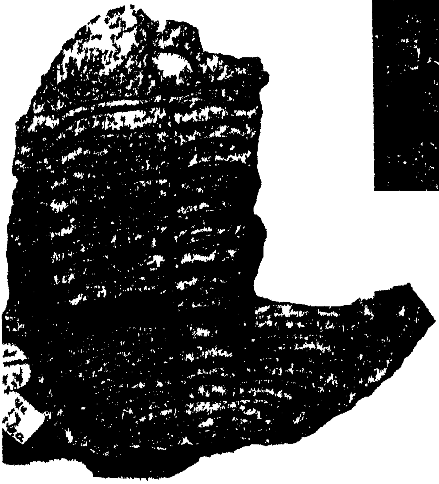
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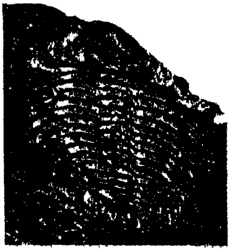
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XXII.—*Undescribed Anatomical Structures and new Species of Reptiles and Amphibians.* By H. W. PARKER, M.A., Department of Zoology, British Museum (Natural History).

AMONG the collections recently received by the British Museum are those made by Lord Moyne in the Caribbean region, Mr. C. A. Hudson in the New River district of British Guiana, on the borders of Dutch Guiana, the Museum's Expedition to East Africa, and Miss L. E. Cheesman in Dutch New Guinea, around Humboldt Bay. All of these contain species of interest, but it is not possible to report upon them fully at the present moment. The following notes on the undescribed species and some anatomical structures exhibited by other species may be of interest to herpetologists.

AMPHIBIA.

SALIENTIA.

Platymantis cheesmanæ, sp. n.

Holotype, a female, number 1938.6.5.28 in the British Museum, from dense forest on the Cyclops Range, Dutch New Guinea, at 3000–4000 feet.

Vomerine teeth in short, oblique series behind the level of the choanæ, each series a little shorter than the interspace between the two. Tongue with an indistinct papilla. Head slightly broader than long; snout obtusely pointed, scarcely prominent, once and a quarter as long as the eye, with curved angular canthus rostralis and slightly oblique, concave, loreal region. Nostril a little nearer the tip of the snout than the eye. Interorbital space as broad as the upper eyelid. Tympanum three-fifths the diameter of the eye. Fingers very feebly dilated, the discs longer than broad, slightly pointed distally, and lacking the crescentic groove separating their upper and lower surfaces; first finger shorter than the second, which is very slightly shorter than the fourth; subarticular tubercles large. Discs of the toes slightly larger than those of the fingers, pointed and with a groove separating the upper and lower surfaces. Toes free, the fifth very much shorter than the third, with prominent subarticular tubercles; an oval inner metatarsal tubercle, continuous with the subarticular tubercle of the inner toe, and a small round outer. Tibio-tarsal articulation reaching the anterior border of the eye.

Dorsum with irregular longitudinal folds, the most conspicuous being two which arise at the posterior ends of the upper eyelids, converge towards one another on the scapular region, and then diverge towards the groins; skin of the flanks and limbs somewhat granular; a strong supra-tympanic fold. Lower surfaces quite smooth.

Pale brownish cream above; a darker, black-edged, mid-dorsal zone commencing between the eyes and bounded by the conspicuous dorsal folds. Loreal region black, this colour continuing over the tympanic region and thence obliquely backwards to the middle of the flanks. Lips with alternating darker and lighter bars. Limbs with narrow black cross-bars. Lower surfaces pale yellowish white stippled with brown on the throat and limbs.

Length from snout to vent 27 mm.

The twelve paratypes, all from the type-locality, show little variation in morphological characters. The tympanum may be only half the ocular diameter, the dorsal folds are variable in their degree of development, the ventral surfaces may be slightly granular, the inner metatarsal tubercle may not be quite continuous with the subarticular, and the tibio-tarsal articulation may reach very slightly beyond the eye. The colour varies from almost uniform pinkish white to a purple-brown; usually some of the dorsal folds are black-edged, or picked out in lighter; the dark cantho-temporal streak is constantly present.

Males have a vocal sac, opening by a slit on either side of the tongue. The largest male measures 23 mm., and the largest female 27 mm.; a female of 26 mm. has ovarian eggs 2·7 mm. in diameter.

This species is allied to *P. corrugata* (Duméril) and *P. punctata* Peters & Doria, but differs from both in its much smaller size, smaller digital discs, and shorter inner finger.

Microhylidæ.

Metopostira ocellata Méhely.

31 ♂♂, ♀♀, & juvs., Cyclops Range, 3000–4000 feet, Dutch New Guinea, March 1936.

2 ♂♂, 3 ♀♀, Mt. Nomo, 600 feet, Jan.-Feb. 1936.

♀, 2 hgr., Njau Limon.

It has already been reported that this species produces large eggs, not less than 3 mm. in diameter, and the whole subfamily (Asterophryinæ) has been presumed to lack a free-swimming larval stage. The juveniles collected in the Cyclops Mts. appear to have just completed their metamorphosis (a tiny vestige of a tail still persisting), and measure 8·5 mm. from snout to vent; they do not appear to have had any free feeding period, for the intestine is packed with yolk.

Sphenophryne macrorhyncha (van Kampen).

♂, ♀, juv., Mt. Nomo, New Guinea.

In existing descriptions of this species or its synonyms there is a great deal of difference of opinion concerning the length and shape of the snout, which has been described as being as long as or shorter than the eye and rounded or moderately pointed. The present examples show that these differences are sex-linked; in the male the snout is strongly prominent, acutely pointed, and longer (1·3) than the eye, whereas in the female and juvenile it is markedly less prominent, less pointed, and only as long as the orbital diameter. The extra length and prominence of the male's snout does not appear to be due to any skeletal difference, but to the development of a pad of soft (? fibrous) tissue underlying the skin at the tip, and may be a seasonal development.

Cophixalus oxyrhinus (Boul.).

8 ♂♂, ♀♀, Cyclops Range, 3000–4000 feet. Dense forest.

2 ♀♀, Mt. Nomo.

The statement that males of this species lack vocal sacs (Parker, 1935, p. 178) is erroneous.

Chiasmocleis hudsoni, sp. n.

A species closely allied to the genotype (*C. albopunctata*), with oval, entire tongue, two smooth ridges on the palate in front of the pharynx, long epicoracoids, maxilla separated from the jugal and free toes, but differing in the proportions of the head, the presence of distinct digital discs on the toes, and in colour.

Holotype, a male, number 1939.1.1.3 in the British Museum, collected by Mr. C. A. Hudson on the New River, British Guiana (750 feet).

Snout rounded, slightly prominent, once and a third as long as the eye; canthus rostralis rounded; loreal region almost vertical, not concave; nostril very slightly nearer the tip of the snout than the eye (1 to 1·2 as compared with 1 to 1·75 in *albopunctata*); tympanum hidden; interorbital space twice as wide as the upper eyelid. Fingers short, slightly depressed, spatulate distally except the inner, which is scarcely more than a conical rudiment; second much shorter than the fourth. Toes moderate, except the inner, which is very short and conical, with distinct, subcircular, terminal discs each with a horseshoe-shaped groove separating the lower adhesive surface from the upper. Subarticular tubercles flat, not well marked; a small inner metatarsal tubercle, but no outer. Tibio-tarsal articulation reaching the posterior corner of the eye.

Skin smooth above and below.

Purple-brown above, with some fine lighter stipplings, which form an indefinite light zone from the tip of the snout above the canthus rostralis, along the edge of the upper eyelid, and thence obliquely towards the flanks, where it becomes indistinct. Flanks and limbs with large areas of light pink stippling. Lower surfaces white, with brown stippling on the gular region and a brown reticulum on the limbs; plantar surface of the foot black.

A vocal sac is present.

Length from snout to vent	17 mm.
Fore limb	7
Hind limb	23

Paratypes, 3 males and 2 females, with the same data as the holotype, numbers 1939.1.1.4–8 in the British Museum.

These specimens are very similar indeed to the holotype both in morphological characters and colour. The largest specimen, a female measuring 20 mm. from snout to vent, appears to be fully mature, with enlarged oviducts and ovaries.

Phrynomerus hoeschi, sp. n.

Holotype. a male, number 1937.12.3.15 in the British Museum, collected at Ombujamatemba (1450 m.), near the Waterberg, S.W. Africa, by Mr. W. Hoesch.

Habitus and proportions similar to those of *P. bifasciatus* (Smith) and *P. affinis* (Boulenger). Snout obliquely truncate, slightly prominent, twice as long as the eye, the latter shorter than its distance from the nostril; tympanum visible but indistinct, as large as the eye; interorbital space much broader than the upper eyelid. Pharyngeal folds as in *P. bifasciatus*. Digits very short, slightly dilated terminally as in *P. affinis*.

Skin glandular but smooth; a large glandular aggregation on the coccygeal region and another on the upper surface of the tibia.

Black above, with numerous small, regularly scattered, circular, red spots which increase in size slightly towards the flanks; a row of these spots forms a broken line along the coccyx. Belly pale brown stippled with lighter, the stipplings increasing in size to form spots on the pectoral region. Throat black, with a few small whitish dots along the edge of the lower jaw.

A vocal sac opening by a slit on each side of the tongue; no nuptial pads.

Length from snout to vent	66 mm.
Snout	7
Eye	3·4
Tympanum	3·4
Interorbit....................	7·0
Fore limb	34·3
Hand	15·0
Hind limb	60
Foot	19·5

The species is closely allied to *P. affinis*, but is distinguished by its larger size and relatively smaller eye (type examined through the courtesy of Dr. Schouteden). The colour also is somewhat different, the red markings being smaller and in the form of regular circles instead of irregular blotches. But, since only one example of each is known, and these from widely separated localities, the possibility of the apparent differences being racial must be considered. The following table gives the comparative proportions of the two, and, for comparison, the same proportional measurements of two sets of specimens of *P. bifasciatus* from equally widely separated areas. The latter figures indicate an appreciable reduction in limb-length in the western series, but since there is probably a complete and gradual transition it is not possible to recognize a definite subspecies.

	P. hoeschi.	*P. affinis.*	*P. bifasciatus.*	
Sex & no. ..	1 ♂.	1 ♂.	3 ♂♂.	4 ♂♂.
Locality ...	Ombujamatemba.	Pweto.	Ombujamatemba.	Boira.
	mm.	mm.	mm.	mm.
Snout to vent	66	48	48–52	41–56
	Per cent.	Per cent.	Per cent.	Per cent.
Snout	10·6	10·4	9·6–10	9·2–10
Eye	5·5	7·7	6·4–7·3	6·8–7·8
Tympanum *	5·5	5·0	3·8–4·5	4·6–5·0
Interorbit ..	11	9·8	8·5–9·7	8·6–10·7
Fore limb ..	52	51	48–58	60–62
Hand	23	24	22–24	23–26
Hind limb ..	91	95	81–89	96–100
Foot	30	31	30–31	31–33

Annulus tympanicus measured after reflection of the overlying skin.

Eleutherodactylus inguinalis, sp. n.

Holotype, a female, number 1939.1.1.1 in the British Museum, collected on the New River, British Guiana, by Mr. C. A. Hudson.

Tongue broadly oval, slightly notched behind. Vomerine teeth in two small groups slightly behind the level of the posterior borders of the choanæ. Head as long as broad, depressed; snout rounded, not prominent, 1·27 times as long as the eye, with obtusely angular canthus rostralis and oblique, slightly concave loreal region; nostril twice as far from the eye as from the tip of the snout; interorbital space once and a half as broad as the upper eyelid; tympanum distinct, its maximum diameter one-third that of the eye. Digits free. First finger shorter than the second; discs of the fingers very large, transversely oval, that of the third finger nearly half the width of the eye; subarticular tubercles prominent. Discs of the toes slightly smaller than those of the outer fingers; subarticular tubercles large and prominent; inner metatarsal tubercle half as long as its distance from the tip of the inner toe; a small outer metatarsal tubercle. Tibio-tarsal articulation reaching a little beyond the anterior corner of the eye.

Skin beset with scattered conical warts above; feebly granular beneath.

Silvery grey above with obscure darker mottlings; traces of a light W-shaped figure behind the occiput; two dark bars radiating from the eye; limbs with obscure cross-bars; fore and hinder side of the thighs and concealed surfaces of the tibia dark brown; a large, chrome-yellow, black-bordered, inguinal ocellus. Lower surfaces white, profusely dusted with brown.

Length from snout to vent	27 mm.
Fore limb	16
Hind limb	40

The paratype, a male with the same data as the holotype, differs only from the latter in size and darker coloration. A vocal sac opening by a long slit on each side of the tongue is present.

Length from snout to vent 20 mm.

The species appears to be allied to *E. latidiscus* Boulenger, but differs in its smaller groups of vomerine teeth, smaller size, colour, and the presence of a vocal sac in the male.

SAURIA.

Sphærodactylus rosauræ, sp. n.

Holotype, a male, number 1938.10.4.1 in the British Museum, collected on Helene Island, Bay Islands, Honduras, 15. xi. 1937, during the cruise of Lord Moyne's yacht 'Rosaura.'

Snout pointed, depressed, concave in profile, 1·46 times as long as the orbit; eye nearer the ear than the tip of the snout. Rostral large, with median cleft; nostril between the rostral, first upper labial, and two nasals; upper nasal separated from its fellow by a single scale. Scales of the upper surface of the snout flat, feebly keeled, of the occiput subtubercular, keeled. Body with large, trihedral, nonimbricate tubercles, about eight of which equal in length the distance from the tip of the snout to the centre of the eye; a distinct mid-dorsal zone of small granules. Mental very large, as long as broad; first pair of labials separated anteriorly by two scales which are not appreciably larger than those adjacent to them; ten rows of these flat scales follow the mental, and then there is a fairly abrupt transition into the small tubercular gulars; ventrals cycloid, imbricate, smooth.

Dorsal tubercles mostly grey, the interstitial spaces dark brown to black; a few scattered tubercles are dark brown, producing a dotted effect. Head and neck brown, with larger black spots which show traces of a vertical arrangement on the sides. Chin and throat dirty white spotted with black; venter yellowish brown.

Length from snout to vent	33 mm.
Fore limb	9
Hind limb	12
Tail incomplete.	

The interest of this new species lies in the fact that it is a member of the *anthracinus*, *fantasticus* group of species, characterized by the mid-dorsal zone of small granules, which Barbour (1921) believes to be wholly Antillean. The discovery of a species of Antillean affinities on an island so close to the mainland might be made the basis of much speculation. But it seems more than possible that our knowledge of these small infrequently collected geckoes is insufficient to warrant such a procedure, and it may be that the type-locality of *S. anthracinus* Cope, "Mexico," believed by Barbour to be erroneous, may be correct after all.

In the size of its dorsal granules and colour *rosauræ* greatly resembles *fantasticus* of Guadeloupe, but has a markedly longer, flatter snout and perfectly smooth ventral scales.

Scincidæ.

Lygosoma (Leiolopisma) cheesmanæ, sp. n.

A *Lygosoma* without supranasals, with a transparent disc in the lower eyelid, paired fronto-parietals, large interparietal, transversely enlarged subdigital lamellæ on the proximal phalanges, acuminate snout, and prefrontals broadly in contact; allied to *L. longiceps* Boul., but differing in its much less acuminate, shorter, snout and colour-pattern.

Holotype number 1938.6.8.95 in the British Museum, collected by Miss L. E. Cheesman at Sabron, Cyclops Mountains, Dutch New Guinea.

Head twice as long as broad; snout acuminate, slightly depressed; ear as large as the eye-opening, without lobules. Nostril in a single nasal; no supra-nasals; fronto-nasal broader than long, forming a broad suture with the rostral, its length contained 2·0 times in the length of the frontal which is nearly as long as its distance from the end of the snout; præfrontals forming a median suture; four supraoculars; eight supraciliaries; interparietal as long as the paired fronto-parietals; parietals forming a suture; five pairs of enlarged nuchals; four labials in front of the subocular. Scales smooth, in 28 rows, the dorsals largest; preanals enlarged. Limbs pentadactyle, well developed, the posterior one-third the length from snout to vent. Digits with enlarged transverse lamellæ beneath the proximal phalanges; beneath the fourth toe eleven proximals and ten narrower distal lamellæ.

Pale copper-colour above; a mid-dorsal row of dark spots forming an interrupted zigzag line from the occiput to the base of the tail; a dark lateral band along the flanks and tail, with a series of large semicircular spots along its upper border forming a regularly festooned margin. Lower surfaces white, with a few brown speckles posteriorly and beneath the tail.

Length from snout to vent	46 mm.
Tail	62
Fore limb	11
Hind limb	15
Head	10·7

This species is undoubtedly very closely allied to *L. longiceps*, but has a markedly shorter head, twice instead of twice and a half as long as broad, a shorter snout (fronto-nasal broader than long and half the length of the frontal, instead of as long as broad and two-thirds the length of the frontal), and a distinctive colour-pattern. *L. longiceps* was described as having only 24 scales around the middle of the body, but the type has 26 and other specimens from the mainland of New Guinea have 26 or 28.

Lygosoma meleagris Boul.

Siaphos meleagris helleri Loveridge, 1932, Proc. Biol. Soc. Washington, xlv. p. 113.

1 juv., Ruwenzori, 8,000 ft.

Loveridge distinguishes *helleri* from *meleagris* by the following characters:—Nostril in an undivided nasal, eight instead of five supraciliaries, præfrontals well developed instead of minute. Nine instead of twelve lamellæ beneath the longest toe, and the back spotted with black instead of white. Actually in the type of *meleagris* there are eight supraciliaries and the nasal is undivided, though an artifact on one side simulates a suture; the degree of development of the præfrontals is a relative matter, and whether they should be described as " minute " or " well-developed " can only be determined by reference to a common standard which does not exist; in both the type and the present example the præfrontals are of the same size—about as large as the first (anterior) supraciliary. There remain only colour and the number of subdigital lamellæ. The present example links the two, having the same number of lamellæ as *meleagris*, but agreeing perfectly with the colour description of *helleri*. Series of specimens might, of course, show that the high altitude form, *helleri* (9500 feet), differs constantly from low altitude *meleagris* (7000 feet) and that the two intergrade at the 8000 feet line. But until series are forthcoming it does not seem wise to continue the use of trinomials.

Tribolonotus gracilis de Rooij.

3 ♂♂, 7 ♀♀, & juvs., Iffar, Lake Sentani, New Guinea.

3 ♂♂, River Armo, Sabron, Cyclops Range, New Guinea.

The presence of plantar pores, similar in appearance to the femoral and preanal pores found in other families, was first discovered in one of the Solomon Islands species of *Tribolonotus* by Roux (1930), and their presence in *T. novæguinæ* was made known by the same author (1934). The same structures are also present in *T. gracilis*, but there are some differences in their disposition in the three, thus :—

(1) *T. schmidti*. Pores present on the plantar surface of both the metacarpal and metatarsal regions, not beneath the phalanges.

(2) *T. novæ-guinæ*. No pores on the fore limbs; on the feet they are arranged in a single series beneath the proximal phalanges of the third and fourth toes, and occasionally beneath the others ; a group of pores on the sole of the foot at the proximal end of the first and second metatarsals.

(3) *T. gracilis*. Pores generally confined to the proximal phalanges of the third and fourth toes ; occasionally one or two pores on other toes or at the proximal end of the first and second metatarsals.

Another structure, not hitherto recorded in this or any other saurian genus, is the presence of a large, abdominal glandular aggregation in males. This aggregation lies about the centre of the abdomen and consists of a variable number of large glands arranged in a double longitudinal series underlying the two median rows of ventral plates. Each gland corresponds in size with a scute and lies between the muscles of the *rectus abdominis*, its inner surface abutting against the peritoneum. Usually there are six of these glands, but, although they appear to be always arranged in two approximated longitudinal series, the number in each row varies from two to four. The glands, which have a large central storage cavity, open to the exterior by a short duct which runs backwards and opens by a large pore under the centre of the posterior margin of the scale. The number and arrangement of these glands is similar both in *T. gracilis* and *T. novæ-guinæ*, so that their presence may be expected in the other species of the genus. The nature of the secretion is unknown, but from the fact that the glands are a male secondary sex-character it seems probable that it has to do with sex-recognition or stimulation, and may well be a scent.

Chamæleontidæ.

Chamæleo bitæniatus ellioti Gunther.

♀. Fort Portal, 5000 ft., Uganda, January 30th, 1935.

Many specimens of this race, including several of the co-types, have one or two inverted folds along each side of the gular region, the skin lining them being jet-black. A similar structure has been described in *C. goetzei* by Loveridge (1933, p. 335).

The present example was kept alive in captivity until March 5th, 1935. At the time of death it was pregnant, and dissection revealed the following facts. The left oviduct contained five mature embryos, with empty yolk-sacs, ready for parturition. They measure 20 mm. from snout to vent, and are light grey in colour, with the two light lateral stripes characteristic of the species and the two black-lined gular folds which have been described above. The raised canthal and supraorbital crests of the adult and the high casque are not developed. The right oviduct contained one similar embryo posteriorly. Immediately anterior to this was a large egg, *circa* 9 mm. long, containing an embryo in a very early stage of development and measuring only 7 mm. from snout to vent. Anterior to this again were four small ovoid masses of yolk, which may represent four degenerate eggs, but are more probably the remnants of a single one which is disintegrated, and at the extreme anterior end of the duct was another full-sized egg in which no trace of an embryo could be found. This condition is very similar to that found in *C. bitæniatus leikipiensis* (q. v.).

Chamæleo bitæniatus leikipiensis Steindachner.

The single female, collected at Thomson's Falls, Western Aberdares (7700 feet), on March 6th, 1935, is referred to this race with an element of doubt. It has some features in common with *höhneli*, and the development of the casque and rostral process is similar to that of the specimen from Kikuyu figured by Sternfeld (1912, pl. xiv. fig. 11) as *C. bitæniatus leikipiensis-höhneli*.

The specimen remained alive in captivity until November 13th, 1935. Dissection then showed it to be pregnant, but, as in the case of *C. bitæniatus elliotí* recorded above, there was considerable disparity between the degree of development of the embryos in the two oviducts. The one contained three embryos in an advanced condition: two of them, measuring 16 mm. from snout to vent, have the pholidosis complete and are pigmented, with only a small quantity of yolk remaining, whilst the third, lying between the other two in the oviduct, is only about half as large, unpigmented, and with the scales not yet developed. The other oviduct contained only two eggs, in both of which the embryos were in a very early stage of development indeed; each measures only about 6 mm. from snout to vent. Even these two are not at the same stage, one showing distinct rudiments of digits and the other having undivided limb-buds; the former is asymmetrical.

Thus there is clear evidence that in two of the subspecies of *C. bitæniatus* embryos in very different stages of development may be present in one female. It might be thought that this was a pathological result of captivity in a climate where the temperature is lower than normal for the species, and so retards the rate of development of the less virile embryos. But the example of *elliotí* was only in captivity slightly over one month, whilst, to judge from the maximum development attained by embryos from the female *leikipiensis*, which was in captivity eight months, the disparity between the embryos corresponds to a considerably longer period than the duration of captivity. Again, successive pairings and fertilizations might be suggested, but it is difficult to believe that, of three eggs lying in one oviduct (*leikipiensis*), the extremes could be fertilized and the centre one remain infertile until a later date.

The asymmetry of one of the very immature embryos in *leikipiensis* and the disintegrated yolk in the right oviduct of *ellioti* indicate that where the development is retarded all is not well, and it is not improbable that these individuals never reach their full development, but are aborted. It is nevertheless obvious that the rate of development of all the embryos of one clutch of eggs is not uniform, and that there is a tendency for the contents of one oviduct to be very much retarded as compared with the other. A similar condition has been recorded in several sea-snakes (Mell, 1929, p. 197), though in those instances no actual embryos were found in the less advanced oviduct, but only large undeveloped eggs. This opens up the possibility that there may be two, or even more, parturitions, resulting from a single pregnancy, and retarded development of this nature may be the explanation of a phenomenon which has been noted in Chelonians (Hildebrand, 1928) and Vipers (Woodward, 1933), viz., several successive clutches of fertile eggs laid after the female has been segregated from the male.

SERPENTES.

Ninia hudsoni, sp. n.

Holotype, a male, number 1939.1.1.9 in the British Museum, collected on the New River, British Guiana, by Mr. C. A. Hudson.

Rostral once and a half as broad as deep; internasals small, half the length of the large præfrontals; frontal once and a third as broad as long, shorter than its distance from the rostral, two-thirds the length of the parietals; loreal scarcely longer than deep; two postoculars; temporals 1+2 or 1+3; seven upper labials, the third and fourth entering the eye. Upper head-scales all striated; chin with conical pustules.

Scales keeled and striated, in 21—21—21 rows. Ventrals 141; anal entire; subcaudals 66+1.

Very dark purple-brown above, with a white nuchal collar as in *N. atrata* (Hallowell); lower surfaces white except the posterior half of the tail, which is brown-dusted.

Length from snout to vent 330 mm.; tail 106 mm.

Paratype an immature male from the same locality, agreeing with the holotype in all essentials. Scales 21—21—21; ventrals 139; subcaudals 65+1.

This form is obviously very closely allied to *N. atrata* and may be found to be a south-eastern race which intergrades with the typical form; it differs in the presence of twenty-one scale-rows, striated head-scales, and shorter snout, reflected in the short high loreal. In sixteen specimens of typical *atrata* (ranging from Costa Rica to Ecuador and Trinidad) the length/depth ratio of the loreal varies from 1·3 to 2·0; in the two specimens of *hudsoni* it is 1·06 and 1·1.

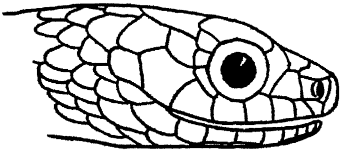
Thrasops jacksoni Günther.

Juv. ♀. Sc. V. 198; C. 141+1. Uganda.

Schmidt (1923, p. 85) has drawn attention to the apparently extraordinary distribution of this species and *T. flavigularis* Hallowell. From the published records it appears that both *T. jacksoni* and *T. flavigularis* occur together in the western forest zone (French Guinea to Dahomey), *T. flavigularis* alone in the central Cameroon–Gaboon area, and *T. jacksoni* again further to the east in the Kenya–Uganda–Ituri region. But this conclusion appears to be entirely false and due to the lack of recognition of a distinct third species. Hitherto specimens from the western zone have been referred to either *jacksoni* or *flavigularis* according to whether they have 19 or 15 scale-rows around the middle of the body; but all the western specimens available to the author, whatever the number of scales, appear to be conspecific and to differ markedly from true *flavigularis* in the size of their dorsal scales. Apparently there are four forms, differentiated as follows:—

I. Scale-rows 15, 17, or 19 at mid-body; ventrals 175–187; subcaudals 121–140. Three lower labials in contact with the lower postocular (fig. 1).

Fig. 1.



Thrasops occidentalis, sp. n. Holotype.

Dorsal scales not appreciably longer than the ventrals (fig. 2 *a*). *Distribution.* French Guinea to Dahomey.

Fig. 2 *a*.

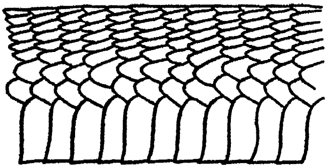


Fig. 2 *b*.

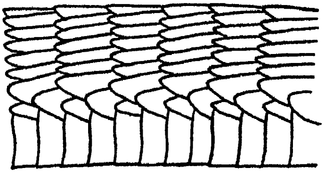
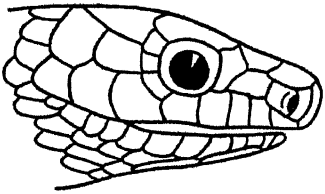


Fig. 2 *a*.—Scales of *Thrasops occidentalis*, sp. n.
Fig. 2 *b*.—Ditto of *Thrasops flavigularis* (Hallowell).

II. Scale-rows 13 or 15 at mid-body; ventrals 196–215; subcaudals 128–146. Two lower labials in contact with the lower postocular. Dorsal scales nearly twice as long as the ventrals except the outermost row, which corresponds with the ventrals (fig. 2 *b*). *Distribution.* S. Nigeria, Cameroon, Gaboon.

III. Scale-rows 19 at mid-body; ventrals 187–214; subcaudals 138–146. Two lower labials in contact with the lower postocular (fig. 3). Dorsal scales not appreciably longer than the ventrals. *Distribution.* Ituri Forest, Kasai Basin, Uganda, Tanganyika Territory.

Fig. 3.



Thrasops jacksoni Günther. Holotype.

IV. Scale-rows 17 at mid-body; ventrals 172–178; subcaudals 140–144. Labials and dorsal scales as in III. *Distribution.* Meru Forest, Kenya Colony.

Names are available for numbers II., III., and IV.—*flavigularis* Hallowell (type-locality "Liberia," subsequently (Hallowell, 1858) corrected to Gaboon), *jacksoni jacksoni* Günther (type-locality Kavirondo), and *jacksoni schmidti* Loveridge (type-locality Meru forest) respectively; but the western form has not yet been named. and may be known as

Thrasops occidentalis, sp. n.

Thrasops flavigularis (part) Boulenger, 1894, Cat. Snakes Brit. Mus. ii. p. 105; id., 1920, Proc. Zool. Soc. London, 1919, p. 283.
Thrasops jacksoni (non Günther) Sternfeld, 1908, Mitt. Zool. Mus. Berlin, iv. 1, p. 215, figs. 2, 3.
Rhamnophis jacksoni (part) Boulenger, 1919, Rev. Zool. Afr. vii. p. 23; id., 1920, Proc. Zool. Soc. London, 1919, p. 284.

Holotype, a female, number 1911.6.30.2 in the British Museum, from Axim, Gold Coast; collected by W. P. Lowe, Esq.

Rostral subquadrangular, a little broader than deep; internasals as long as the præfrontals; frontal nearly as broad as long, longer than its distance from the rostral but slightly shorter than the parietals; no enlarged occipitals; loreal as long as deep; one præocular, reaching the upper surface of the head but separated from the frontal; three postoculars, the lower longest and in contact with three upper labials; temporals 1+1; eight upper labials, the fourth and fifth entering the eye; four lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales oblique, in nineteen rows at mid-body, not longer than the ventrals, the five median rows keeled; ventrals 187, anal divided; subcaudals 122+1. Black above; dark olive beneath; the chin, throat, and sides of the head straw-coloured.

Length from snout to vent 1085 mm.; tail 403 mm.

Paratypes.

B.M. 94.3.24.30, ♂. Monrovia, Liberia. Sc. 15, all except the outer keeled. V. 187. C. 131+1. Loreal slightly longer than deep.

B.M. 66.1.28.6, ♂. Sierra Leone. Sc. 15, all keeled. V. 179. C. 130+1. Length from snout to vent 1165 mm.; tail 495 mm.

B.M. 1912.9.18.3, ♂. Dunkwa, Gold Coast. Sc. 19, all keeled. V. 175. C. 132+1.

B.M. 1909.2.23.4, ♂. Diteien, French Guinea. Sc. 17, all keeled. V. 177. C. 140+1. Each subcaudal has a white central spot.

B.M. 1911.5.29.9–10, juv., ♂♂. Gold Coast. Sc. 19, smooth or the three dorsal rows keeled. V. 180, 182. C. 121+1, 127+1. In both the frontal is longer than its distance from the end of the snout; in one the seventh and eighth upper labials are fused. The juvenile livery is as follows:—Head and neck uniform olive; remainder of dorsum with a chess-board pattern of subrectangular black and yellow spots arranged in 6–8 longitudinal series; chin, throat, and sides of the head whitish, with the sutures between the scales picked out in black; belly black, the ventral scutes with alternately two or three transversely oval, yellow spots; subcaudals yellow, black-margined.

This western forest form certainly appears to be more closely allied to *T. jacksoni* than to its geographical neighbour *T. flavigularis.* Possibly a single ancestral species formerly ranged across the whole equatorial forest-belt and gave rise in the central area to the large-scaled *flavigularis*; the peripheral remnants, isolated from one another, underwent but slight differentiation, and retain a greater resemblance to each other than either does to the derived species.

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XXIII.—*New or little-known* Tipulidæ (*Diptera*).—LVII. *Neotropical Species.* By CHARLES P. ALEXANDER, Ph.D., F.R.E.S., Massachusetts State College, Amherst, Massachusetts, U.S.A.

THE interesting series of crane-flies described at this time were secured in various parts of eastern Ecuador by Mr. William Clarke-Macintyre and native collectors. I express my very deep thanks to the collectors for their continued interest in saving these too often neglected flies. The types are preserved in my personal collection.

Ozodicera (*Ozodicera*) *trispinifer*, sp. n.

General coloration brownish grey, the præscutum with four concolorous stripes that are narrowly bordered by more reddish brown; antennæ with basal three segments obscure brownish yellow, the remaining segments black; flagellar branches short; wings brownish grey, the base and costal border more brownish yellow; abdominal tergites reddish brown, trivittate with dark brown; sternites yellow; male hypopygium with inner dististyle complex, its outer arm trispinous, the more slender inner arm bifid at apex.

Male.—Length about 25 mm.; wing 20 mm.; antenna about 5·8 mm.

Frontal prolongation of head brownish black, subequal in length to remainder of head; nasus conspicuous; palpi black. Antennæ relatively long; basal three segments obscure brownish yellow, the remaining segments black; flagellar branches relatively short and stout, simple, subequal in length to the segments; terminal simple segments progressively elongate. Head brownish grey; anterior vertex narrow, a little more than one-half the diameter of the scape.

Mesonotal præscutum brownish grey, with four concolorous stripes that are narrowly bordered by more reddish brown; scutum reddish brown; scutellum grey, parascutella more reddish; postnotum more yellowish grey pruinose. Pleura chiefly light grey. Halteres infuscated. Legs with coxæ pale, dusted with grey; trochanters yellow; femora reddish brown; tibiæ brown; tarsi black. Wings brownish grey, the prearcular and costal regions, with the stigma, brownish yellow; veins brown. Venation: distal half of R_{1+2} pale; R_2 short; *r–m* reduced; cell M_1 broadly sessile.

Abdominal tergites reddish brown, trivittate with dark brown, restricting the ground-colour to sublateral lines; sternites yellow. Male hypopygium with the inner dististyle heavily sclerotized and very complex in structure; outer arm short and broad, trispinous at apex, the median spine short; inner arm longer than the outer, its stem slender, at apex conspicuously bifid, the outer branch a curved flattened spine, the inner branch more expanded at apex.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, Rio Pastaza, altitude 1200 metres April 11, 1937 (*Macintyre*).

The most similar species is *Ozodicera* (*Ozodicera*) *bispinifer* Alexander, of Amazonian Brazil, which is somewhat smaller and with the hypopygium, especially the inner dististyle, differently constructed.

Holorusia lassula, sp. n.

Size large (wing, ♂, over 20 mm.); general coloration dark brown, the præscutum and scutum variegated with more reddish brown; pleura with a conspicuous longitudinal yellow stripe; antennæ elongate, the segments vaguely serrate; wings with a strong brown tinge, sparsely patterned with darker brown and cream-coloured areas; male hypopygium with the tergite small, its apex trilobed; outer dististyle flattened, the apex truncate and produced into about eight spinous points.

Male.—Length about 16–18 mm.; wing 21–24 mm.; antenna about 7–7·5 mm.

Frontal prolongation of head relatively long, subequal in length to remainder of head, brownish black; nasus long and conspicuous; palpi black, the incisures restrictedly paler. Antennæ (male) elongate; basal three or four segments obscure yellow, the outer segments passing into black; flagellar segments elongate, without basal swelling; each flagellar segment arises from the oblique apex of the preceding, so the latter is slightly extended beyond the base of the next, producing a feebly serrated appearance. Head deep cinnamon brown, the vertex with a more or less distinct paler median vitta; posterior orbits more or less pruinose; anterior vertex about two-and-one-half times the diameter of the scape.

Pronotum chiefly yellow, especially on sides. Mesonotum chiefly and almost uniformly dark brown, the præscutum with indications of four more reddish-brown stripes, the centres of the scutal lobes similarly brightened. Pleura with a broad, conspicuous, yellow stripe extending from the pronotum to beneath the wing-root, involving the dorsopleural membrane; ventral pleurotergite more silvery, forming the posterior end of the yellow pleural stripe; a black longitudinal stripe lying ventrad of the yellow one; remainder of pleura greyish, vaguely patterned with brown. Halteres dusky, base of stem yellow. Legs with coxæ and trochanters pale brown; femora brownish yellow, the tips more blackened, in cases with a poorly indicated subterminal ring; tibiæ and tarsi brown, passing into black, the tibial bases restrictedly yellow. Wings with a strong brown tinge, the oval stigma darker brown; restricted brown clouds at arculus, origin of *Rs* and *m–cu*; small cream-coloured spots in outer cells, including cells R_5, two in M_1, one in base of *2nd* M_2, and one in outer end of cell *1st* *A*; pale areas before and beyond origin of *Rs* and along vein *Cu* in cell *M*; veins brown. Venation: R_3 not strongly arcuated, weakly angular at mid-length.

Abdomen relatively short; tergites dark brown, more or less variegated with obscure yellow; sternites yellow; apex of hypopygium paling to yellow. Male hypopygium with the tergite small, its apex trilobed, the median lobe broader than the laterals; lobes set with strong blackened setæ. Outer dististyle flattened, curved, the apex truncate, with about eight irregular pale teeth.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, Rio Pastaza, altitude 1200 metres, September 21, 1937 (*Macintyre*). *Paratopotype*, ♂, August 20, 1937 (*Macintyre*).

Holorusia lassula is quite distinct from all other regional species of the genus in the elongate antennæ of peculiar structure, the pattern of the wings, and, especially, the structure of the male hypopygium.

Tipula obirata, sp. n.

General coloration of mesonotum obscure brownish yellow, the præscutum with three black stripes, the median one partly split by a pale line; a conspicuous black spot on dorsopleural region; scutellum pale; postnotum brownish black; knobs of halteres dark brown; femora yellow, the tips narrowly black; wings yellow, variegated with pale brown and dark brown; R_{1+2} atrophied; basal abdominal tergites yellow, blackened laterally; valves of ovipositor slender.

Female.—Length about 12 mm.; wing 13 mm.

Frontal prolongation of head yellow, including the nasus, the latter tufted with black setæ; palpi black. Antennæ with scape and pedicel yellow, flagellum black; verticils (female) shorter than the segments. Head buffy, scarcely darker medially; vertical tubercle low and inconspicuous.

Pronotum yellow. Mesonotal præscutum nitidous, obscure brownish yellow, with three black stripes, the median one partly split by a pale line; a conspicuous black spot on dorsopleural region opposite the cephalic end of the lateral stripe; scutal lobes brownish black, the median region testaceous; scutellum yellow, parascutella brownish black; postnotum, including both mediotergite and pleurotergite, brownish black. Pleura chiefly yellow, the anepisternum and sternopleurite more variegated with brown. Halteres with stem yellow, knob dark brown. Legs with the coxæ and trochanters yellow; femora yellow, the tips narrowly blackened, the amount subequal on all legs, the tips preceded by a scarcely differentiated clearer yellow ring; tibiæ yellowish brown, the tips narrowly blackened; tarsi black. Wings with the ground-colour cream-yellow, variegated with dark and pale brown areas; prearcular region and interspaces of cell *Sc* brighter yellow; darker areas arranged as follows: postarcular and stigmal, with two further subcostal spots between, the second at origin of *Rs*, these two areas interconnected posteriorly in cells *R* and *M*; paler brown areas extensive, subequal in extent to the yellow ground, the latter appearing chiefly as an incomplete band beyond stigma, bases of outer medial cells, and as two broad bands crossing the wing before cord, one subbasal, the second before cord and not quite reaching the posterior border; veins yellow in the ground, darker in the clouded areas. Venation: R_{1+2} atrophied; *Rs* and R_3 subequal in length; petiole of cell M_1 subequal to *m*; *m–cu* connecting with vein M_4, the basal section of the latter long and perpendicular.

Basal abdominal tergites yellow, blackened laterally, the outer tergites more obscure brownish yellow, variegated sublaterally with dark brown or brownish black, the extreme margins pale; sternites obscure brownish yellow, variegated with darker brown on either side; genital shield yellow; cerci long and slender; hypovalvæ and bases more blackened.

Hab. Ecuador (Oriente).

Holotype, ♀, Yunguilla, Rio Blanco, altitude 1900 metres, August 3, 1937 (*Macintyre*).

In the wing-pattern and venation this fly is most similar to *Tipula fraudulenta* Alexander, likewise from Ecuador, differing conspicuously in the body-pattern, coloration of the antennal flagellum, pattern of the femora and other characters. It is possible that both of these species are better placed in the subgenus *Microtipula* Alexander, despite the major size.

Tipula jubilans, sp. n.

General coloration yellow, the præscutum with dark spots at cephalic median portion and behind each pseudosutural fovea; femora yellow, the tips narrowly black; tibiæ and tarsi uniformly black; wings yellow, handsomely patterned with brown; vein R_{1+2} entire; abdomen yellow, the lateral margin of second tergite narrowly blackened.

Female.—Length about 12 mm.; wing 12 mm.

Frontal prolongation of head yellow; nasus distinct; palpi with basal two segments brown, the terminal segments dark brown. Antennæ with scape and pedicel light yellow; first flagellar segment brownish yellow, remaining segments black, with long verticils. Head fulvous brown, the anterior vertex yellow, about four times as wide as the diameter of scape.

Pronotum yellow. Mesonotal præscutum fulvous yellow, the usual stripes scarcely differentiated except by their more polished nature, the extreme cephalic end of median stripe brownish black; a circular black spot on margin of præscutum, immediately behind the pseudosutural foveæ; posterior sclerites of notum fulvous yellow. Pleura, including the dorsopleural membrane, yellow. Halteres yellow, the base of knob weakly darkened. Legs with the coxæ and trochanters yellow; femora obscure yellow, the tips rather narrowly but conspicuously black, the amount subequal on all legs, the ring preceded by a more or less distinct clearer yellow annulus; tibiæ and tarsi entirely black. Wings with the ground-colour yellow, the prearcular and costal portions more saturated yellow; a restricted brown pattern, as follows: a major blotch at *h*, extending caudad and expanded, reaching vein Cu_2 behind; spot at origin of *Rs* and another before mid-length of vein *R*; a larger darkening in cell *M* adjoining vein *Cu* at near two-thirds its length; stigma darker brown, confluent with a dark cloud on anterior cord; all outer radial and medial cells darkened, with conspicuous central areas of the pale ground-colour, the dark colour thus more or less confined to the veins; more restricted brown washes in outer ends of anal cells; veins dark brown, yellow in the ground areas. Squama naked. Venation: R_{1+2} entire, its basal half with trichia; *Rs* more than twice *m–cu*; petiole of cell M_1 subequal to *m*.

Abdominal tergites yellow, the lateral margin of second tergite narrowly blackened; sternites light yellow. Ovipositor with cerci nearly straight, horn-coloured.

Hab. Ecuador (Oriente).

Holotype, ♀, Abitagua, Rio Pastaza, altitude 1200 metres, September 20, 1937 (*Macintyre*).

Tipula jubilans is very different from the other species of the genus so far made known. The lack of dark clouding near the outer end of cell *M* distinguishes the species from other regional forms that have the wing-pattern generally similar.

Tipula (*Microtipula*) *fatidica*, sp. n.

General coloration yellow, variegated with black; antennal flagellum uniformly black; head dark grey; præscutum with a conspicuous black stripe on lateral border; posterior sclerites of notum and pleura chiefly darkened; halteres yellow, the knob dark brown; tibiæ and tarsi black; wings whitish cream colour, heavily patterned with brown; cell *C* almost uniformly infuscated, cell *Sc* variegated alternately with brown and yellow; outer abdominal segments uniformly blackened.

Male.—Length about 10 mm.; wing 10 mm.; antenna about 2·3 mm.

Frontal prolongation of head dark brown; nasus scarcely developed; palpi black. Antennæ of moderate length, if bent backward about reaching the wing-root; scape and pedicel yellow, flagellum black; flagellar segments nearly cylindrical, the basal enlargements not or scarcely developed; longest verticils a little shorter than the segments. Front yellow; vertex dark grey; vertical tubercle very small.

Pronotum yellow. Mesonotal præscutum obscure yellow, with three black stripes, the surface nitidous; lateral margin of præscutum opposite anterior ends of præscutal stripes and partly involving the dorsopleural membrane intensely black; posterior sclerites of notum chiefly darkened, the scutellum and central area of mediotergite testaceous. Pleura obscure yellow, heavily variegated with brown, the pleurotergite blackened; dorsopleural membrane yellow. Halteres yellow, the knob dark brown. Legs with the fore and middle coxæ dark brown, posterior coxæ yellow; trochanters yellow; femora yellow basally, passing into brown at near mid-length, the tips broadly blackened, preceded by a clearly-defined yellow ring of nearly equal width; dark postmedial ring less indicated on posterior than on other legs; tibiæ and tarsi black. Wings with the ground-colour whitish cream colour, very heavily patterned with brown; prearcular field chiefly darkened; cell *C* almost uniformly infuscated, a little darker at *h*; cell *Sc* chiefly dark, with alternating yellow areas, the two lying basad of origin of *Rs* much reduced, the third outer area more extensive; remainder of disk with the brown and cream areas nearly equal in extent, the latter including a broad nicomplete cross-band beyond cord, bases of outer medial cells and extensive areas in the basal and anal cells; an extensive postarcular darkening in bases of cells *R* and *M*; veins dark, pale in the ground areas. Venation: *Rs* straight, R_{2+3} long, about one-half *Rs*; R_3 long and straight, subequal to *Rs*; basal section of M_{1+2} long and nearly erect, cell *1st* M_2 thus unusually high, its greatest length about one-half more than the width; cell *2nd A* narrow.

Basal abdominal tergite yellow; segments two and three extensively variegated with black; fourth and succeeding segments uniformly black; basal sternites brownish yellow, the sixth and outer segments black.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Baños, altitude 1900 metres, May 10, 1935 (*Macintyre*).

The nearest described relative is *Tipula* (*Microtipula*) *atrovelutina* Alexander, of Paraguay, which differs in numerous details of coloration of the body, halteres, legs and wings.

Tipula (*Eumicrotipula*) *petiolaris*, sp. n.

General coloration brown, præscutal stripes scarcely evident; frontal prolongation of head yellow above, blackened on sides; antennal flagellum bicoloured; pleura brownish black, variegated with yellow; legs black, the femora with a narrow yellow subterminal ring; wings cream-yellow, variegated with dark and lighter brown areas; dark costal areas not interconnected behind; macrotrichia in outer two-thirds of cells beyond cord; petiole of cell M_1 exceeding vein *m*; abdominal segments dimidiate, brownish black to black, the posterior borders broadly yellow.

Female.—Length about 7·5 mm.; wing 9 mm.

Frontal prolongation of head obscure yellow above, blackened on sides; nasus very reduced; palpi black. Antennæ with scape and pedicel light yellow; flagellar segments bicoloured, black basally, the distal ends yellow, the bicolorous nature extending to the terminal segment. Head dark brown behind, paler brown on anterior vertex; front buffy.

Mesonotum brown, the præscutal stripes scarcely evident; posterior sclerites of notum dark brown. Pleura brownish black, variegated with yellow on dorsopleural membrane, on ventral pteropleurite and along suture between sternopleurite and anepisternum. Halteres long, stem yellow, knob dark brown. Legs with the fore coxæ darkened, the remaining coxæ testaceous yellow; trochanters yellow; femora brownish black, restrictedly obscure yellow at base, the tips black, preceded by a slightly narrower, clear yellow ring; tibiæ and tarsi black. Wings with the ground-colour cream-yellow, heavily marbled with dark and lighter brown; cell *C* pale brown, except at the ends; large darker brown areas at arculus, mid-length of cell *Sc*, origin of *Rs*, and stigma, the areas not interconnected posteriorly, the centre pair not invading cell *C*; beyond the cord, the cells brown, checkered with small ground spots, including a nearly marginal series at ends of cells; basad of cord, the ground-colour exceeds the dark in amount, especially in cells *R* and *M*; major dark areas in cell *M* at outer end and near mid-length; veins yellow in the ground areas, darker elsewhere. Macrotrichia in outer two-thirds of cells beyond cord. Venation: cell M_1 long-petiolate, the petiole exceeding vein *m*; *m–cu* on M_4 just beyond origin; M_{3+4} only about two-thirds the basal section of M_{1+2}.

Abdomen with the segments dimidiate, brownish black to black basally, the posterior borders broadly yellow.

Hab. Ecuador (Oriente).

Holotype, ♀, Mapoto, Rio Pastaza, altitude 1400 metres, September 28, 1938 (*Macintyre*).

The other species of *Eumicrotipula* are from southern Brazil and northern Argentina, these including *T.* (*E.*) *hostifica* Alexander, *T.* (*E.*) *iguazuensis* Alexander, the subgenotype *T.* (*E.*) *macrotrichiata* Alexander, and *T.* (*E.*) *perstudiosa* Alexander. All of the above species, having cell M_1 petiolate, have the macrotrichia of the cells much more extensive and the wing-pattern quite distinct, with the dark costal areas interconnected posteriorly in cell *R*.

Limonia (*Neolimnobia*) *interstitialis*, sp. n.

General coloration yellow, the pronotum and anterior third of præscutum with a median brown stripe; legs dark brown; wings pale yellow, very sparsely patterned with brown; *Sc* short; supernumerary cross-vein in cell R_3 in direct transverse alignment with vein R_2; cell 1*st* M_2 longer than any of the veins beyond it; *m–cu* at fork of *M*; ovipositor with small slender cerci.

Female.—Length about 7 mm.; wing 7 mm.

Rostrum brown; palpi black. Antennæ with scape yellow, pedicel dark brown, flagellum black; basal flagellar segments short and crowded, the outer ones oval with well-marked incisures; terminal segment longer than the penultimate. Head dark brown.

Pronotum yellow, narrowly dark brown medially. Mesonotum reddish yellow, the præscutum with a dark brown median line on anterior third; scutellum and mediotergite more broadly but less distinctly darkened medially. Pleura yellow. Halteres with stem pale, knob dark brown. Legs with coxæ yellow; trochanters greenish; remainder of legs dark brown; claws with a major outer spine and about two smaller basal ones. Wings with a very pale yellow tinge, sparsely patterned with brown, appearing as seams at arculus, origin of *Rs*, fork of *Sc*, cord, R_2, supernumerary cross-vein in cell R_3 and along the outer end of cell *1st* M_2; veins brown. Venation: *Sc* short, Sc_1 ending shortly beyond origin of *Rs*, Sc_2 at its tip; *Rs* long, angulated and short-spurred at origin; a supernumerary cross-vein in cell R_3 in direct transverse alignment with R_2; cell *1st* M_2 longer than any of the veins beyond it; *m–cu* at fork of *M*, longer than distal section of Cu_1; cell *2nd A* wide. One wing of type has an adventitious cross-vein in cell R_3, additional to the supernumerary.

Abdominal tergites obscure brownish yellow, the incisures a little darker, to produce a weak dimidiate effect; basal sternites more uniformly yellow. Ovipositor with cerci slender, gently curved, much smaller and weaker than the strong hypovalvæ.

Hab. Ecuador (Oriente).

Holotype, ♀, Mapoto, Rio Pastaza, altitude 1300 metres, October 1, 1938 (*Macintyre*).

The general appearance of the present fly is more as in the *repanda* group of the typical subgenus *Limonia*. I am referring it to *Neolimnobia* with much question and solely on the basis of the presence of a supernumerary cross-vein in cell R_3 of the wings. It is very different from all other species of *Neolimnobia* and the members of the *repanda* group.

Limonia (*Geranomyia*) *rabula*, sp. n.

General coloration pale brownish testaceous, the præscutum unstriped; rostrum elongate; knobs of halteres infuscated; legs brown; wings with a brownish tinge, the oval stigma darker brown; Sc_1 ending shortly before mid-length of *Rs*; abdominal tergites dark brown, sternites yellow, male hypopygium with the ventral dististyle large and fleshy; rostral prolongation small, with two long spines from a low common tubercle.

Male.—Length, excluding rostrum, about 6 mm.; wing 7·5 mm.; rostrum about 4·2 mm.

Rostrum long, brown; labial palpi slender; palpi dark brown. Antennæ about one-third the length of rostrum, black; flagellar segments oval, poorly delimited. Head dark grey; anterior vertex reduced, a little narrower than the diameter of the scape.

Thoracic dorsum almost uniformly pale brownish testaceous, præscutum unstriped; scutal lobes and scutellum a trifle darker. Pleura yellow, the anepisternum a little darker. Halteres short, stem yellow, knob infuscated. Legs with the coxæ and trochanters pale yellow; remainder of legs brown, tibiæ and tarsi somewhat darker; claws almost simple. Wings with a brown tinge, unmarked except for the oval, darker brown stigma; veins dark brown. Venation: *Sc* moderately long, Sc_1 ending shortly before mid-length of *Rs*, Sc_2 at its tip; supernumerary cross-vein in cell *Sc* at near mid-distance between arculus and origin of *Rs*; *r–m* reduced; cell 1st M_2 a little shorter than vein M_{1+2} beyond it; *m–cu* at fork of *M*.

Abdominal tergites dark brown, sternites yellow; hypopygium brownish yellow. Male hypopygium with the caudal margin of tergite subtransverse, feebly to scarcely notched. Basistyle small. Ventral dististyle very large, with small rostral prolongation; rostral spines elongate, about one-half longer than the prolongation, arising from a low common tubercle, subequal to one another in length. Gonapophyses with mesal-apical lobes pale, at tips strongly curved into acute points.

Hab. Ecuador (Oriente).

Holotype, ♂, Baños, Tungurahua, altitude 2000 metres, May 25, 1937 (*Macintyre*).

Limonia (*Geranomyia*) *radula* somewhat resembles *L.* (*G.*) *turbida* (Alexander) but is readily told by the structure of the male hypopygium.

Limonia (*Geranomyia*) *inæquispinosa*, sp. n.

General coloration pale reddish yellow, the præscutum with a single median brown stripe; pleura unmarked; femora pale brown, deepening to a darker ring before the yellow tips; wings ochreous, very sparsely patterned with brown, including a common area at origin of *Rs* and fork of *Sc*; cell 1*st* M_2 elongate, exceeding any of the veins beyond it; male hypopygium with the rostral spines of the ventral dististyle arising from separate tubercles, very unequal in size, the outer hair-like.

Male.—Length, excluding rostrum, about 6 mm.; wing 7 mm.; rostrum about 3 mm.

Rostrum about one-half the length of remainder of body, black, the labial palpi a little paler. Antennæ black throughout; flagellar segments suboval. Head grey, darker behind.

Mesonotal præscutum reddish yellow with a single, darker brown, median stripe, the humeral region slightly tinged with green; scutal lobes weakly infumed, the median area pale; scutellum uniformly pale yellow; mediotergite darkened. Pleura uniformly reddish yellow, unmarked. Halteres with stem yellow, knob tinged with greenish. Legs with the coxæ and trochanters pale yellow; femora pale brown, deeper outwardly to form a vague ring before the broad yellow apex; tibiæ and tarsi brown. Wings tinged with ochreous, the prearcular field and cell *Sc* clearer yellow; a restricted brown pattern, including the oval stigma; a small cloud at the supernumerary cross-vein in cell *Sc*; a small common area involving the origin of *Rs* and fork of *Sc*; vague to scarcely apparent seams along cord and outer end of cell 1*st* M_2; extensive but very pale brown clouds at ends of *Cu* and both anal veins; veins yellow, darker in the clouded areas. Venation: *Sc* short, Sc_1 ending shortly beyond origin of *Rs*, Sc_2 at its tip; supernumerary cross-vein in cell *Sc* at near mid-length of cell; cell 1*st* M_2 elongate, exceeding any of the veins issuing from it; *m–cu* close to fork of *M*.

Abdomen light brown; hypopygium slightly paler. Male hypopygium with the tergite moderately emarginate. Ventral dististyle relatively extensive, its area about twice that of the basistyle; rostral prolongation relatively slender, with two spines that are entirely separate arising from small basal tubercles; proximal spine much stouter and a little longer than the hair-like outer spine. Gonapophyses with mesal-apical lobes long and slender, pale.

Hab. Ecuador (Oriente).

Holotype, ♂, Baños, Tungurahua, altitude 2000 metres, May 25, 1937 (*Macintyre*). *Paratopotypes*, 2 ♂♂.

Limonia (*Geranomyia*) *inæquispinosa* is quite distinct from all allied regional species, having a single præscutal stripe, yellow femoral tips and sparsely patterned wings, with a common dark area at origin of *Rs* and fork of *Sc*. The structure of the male hypopygium is distinctive.

Limonia (*Geranomyia*) *destricta*, sp. n.

General coloration of mesonotum obscure yellow, with three narrow brown discal stripes, together with more broadly darkened lateral margins; wings heavily patterned with brown, including major areas at base, supernumerary cross-vein in cell *Sc*, stigma and cord, wing-apex and marginal clouds at ends of anal veins; ground area beyond cord broad; male hypopygium with the two rostral spines arising from a common tubercle; mesal-apical lobes of gonapophyses slender, gently curved, the tips acute.

Male.—Length, excluding rostrum, about 6·5 mm.; wing 8·8 mm.; rostrum about 4 mm.

Rostrum relatively long, exceeding one-half the body in length; both the labrum and labial palpi of unusual length, brownish black, the tips of the palpi a little brightened. Antennæ brownish black, with inconspicuous verticils. Head black, the vertex with a capillary silvery median vitta that is equal in width to the anterior vertex.

Pronotum ochreous, a little darker medially. Mesonotal præscutum obscure yellow, sparsely pruinose, with three narrow brown stripes, the lateral borders of the sclerite more broadly darkened; median area of scutum yellow, lobes brownish grey, encircled by dark brown; scutellum obscure yellow; mediotergite reddish brown, the cephalic portion more darkened Pleura reddish, the anepisternum conspicuously darkened, the pteropleurite and pleurotergite less evidently so. Halteres yellow, the knobs dark brown. Legs with the coxæ and trochanters obscure yellow; remainder of legs broken. Wings with the ground colour yellow, the costal border more saturated; an unusually heavy brown pattern, as follows: postarcular in cells *Sc* and *R*; at supernumerary cross-vein in cell *Sc*, involving cells *C*, *Sc* and *R*, more extensive than the pale interspaces on either side; a major common area at origin of *Rs* and fork of *Sc*, interrupted by a tiny pale spot in cell *Sc* but broadly continuous in cells *R* and R_1; stigma, fork of *Rs* and cord, all interconnected; outer end of cell 1*st* M_2, connected with an extensive apical clouding in cells Sc_2 to M_4; major dark clouds at ends of anal veins; vague pale brown washes in cells *M*, *Cu* and 1*st A*; veins yellow, darker in the clouded areas. Venation: *Sc* moderately long, Sc_1 ending about opposite one-third the length of *Rs*, Sc_2 near its tip; free tip of Sc_2 longitudinal in position and a little longer than R_2; cell 1*st* M_2 elongate, subequal to vein M_{1+2} beyond it; *m–cu* at fork of *M*, a little shorter than distal section of vein Cu_1.

Abdomen, including hypopygium, light brown, the caudal borders of the segments vaguely paler. Male hypopygium with the dorsal dististyle narrower than in *tatei*. Ventral dististyle larger, the rostral prolongation and spines very similar, the latter arising from a common tubercle at extreme base of prolongation. Gonapophyses with mesal-apical lobes appearing as slender, gently curved horns, with a very low flange on margin at near mid-length, the tips acute.

Hab. Ecuador (Oriente).

Holotype, ♂, Baños, Tungurahua, altitude 2000 metres, May 25, 1937 (*Macintyre*).

The nearest relative seems undoubtedly to be the smaller *Limonia* (*Geranomyia*) *tatei* Alexander, of the summit of Mount Roraima, which is distinguished by the wing-pattern and structure of the male hypopygium.

Teucholabis (*Paratropesa*) *subcollaris*, sp n.

General coloration black, without metallic reflections; antennæ black throughout; posterior femora yellow, with narrow brown subbasal and subapical rings; posterior tibiæ brownish yellow; wings whitish subhyaline, patterned with brown, including a darkened area in bases of cells *Cu* and 1*st A* that does not involve cells *R* or *M*; abdominal tergites uniformly black; apical spine of basistyle small and slender.

Male.—Length about 6 mm.; wing 5·5 mm.

Rostrum yellow; palpi dark brown. Antennæ black; flagellar segments oval. Head black, paler on front and occiput.

Pronotum pale yellow. Mesonotum and pleura black, without blue or purple reflections. Halteres with stem brownish black, knob light yellow. Legs with fore and middle coxæ yellow, posterior coxæ darker; trochanters yellow; fore femora black; middle femora yellow; posterior femora yellow, with a narrow dark ring beyond base and a similar narrow ring before apex, both base and tip being narrowly pale; fore tibiæ and tarsi black; middle tibiæ pale brown, the tarsi darker outwardly; posterior tibiæ brownish yellow, tarsi black; posterior basitarsi conspicuously dilated on more than basal half. Wings whitish or very pale yellowish subhyaline, patterned with pale brown; a dark cloud in bases of cells *Cu* and 1*st A*, not involving cells *R* or *M*; a relatively narrow band before and at cord, beginning at the darker brown stigma, completely traversing the wing; outer band involving the broad apex, back to the level of outer end of cell 1*st* M_2; veins dark brown, pale in the whitened prearcular field. Venation: Sc_1 ending just beyond origin of the strongly arcuated *Rs*; R_2 at fork of *Rs*; R_3 present in the left wing of the holotype, entirely atrophied in the right wing; a long fusion of veins R_5 and M_{1+2} to beyond mid-length of cell 1*st* M_2; *m–cu* shortly before fork of *M*.

Abdominal tergites black; second sternite with a narrow yellow ring; hypopygium black. Male hypopygium with the apical spine of basistyle small and very slender. Ædeagus terminating in a short, gently curved spine.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, Rio Pastaza, altitude 1200 metres, September 18, 1937 (*Macintyre*).

Teucholabis (*Paratropesa*) *subcollaris* is most similar to *T.* (*P.*) *collaris* (Osten Sacken), of Amazonian Brazil, differing in the diagnostic characters given above. It seems certain that several species have been confused under the comprehensive name *collaris*.

Teucholabis (*Teucholabis*) *atripennis*, sp. n.

General coloration of thorax deep reddish brown, abdomen black; halteres black; legs black, the femoral bases pale, most extensively so on posterior legs; posterior tibiæ dilated and pale yellow shortly before tip; wings strongly suffused with blackish, unpatterned;

Sc ending beyond mid-length of *Rs*; branches of *Rs* parallel to one another; male hypopygium with apical spine of basistyle short, provided with setæ and weak spines; outer dististyle simple; inner dististyle terminating in a simple cultrate blade.

Male.—Length about 7 mm.; wing 7·5 mm.

Rostrum black, nearly equal in length to remainder of head; palpi black. Antennæ black throughout; flagellar segments oval. Head dark.

Mesonotal præscutum deep reddish brown; scutum and scutellum blackened; mediotergite dark, paler on posterior portion. Pleura chiefly deep reddish brown. Halteres black throughout. Legs with coxæ yellowish testaceous; remainder of legs black, femoral bases paler, widest on posterior legs where only the distal fourth is blackened; posterior tibiæ with a narrow, pale yellow, subterminal ring on the dilated portion; posterior tibiæ near tip and basitarsi on proximal third conspicuously dilated. Wings strongly suffused with blackish, the outer radial field somewhat darker; stigma oval, darker brownish black; veins dark brown. Venation: Sc_1 ending nearly opposite three-fifths the length of *Rs*; R_{2+3+4} about one-third the length of R_2; branches of *Rs* parallel to one another for their entire length, cell R_2 at margin thus very wide; inner end of cell 1*st* M_2 lying slightly proximad of other elements of cord, *m–cu* shortly beyond fork of *M*.

Abdomen, including hypopygium, black. Male hypopygium with the apical spine of basistyle simple, short and broad at base, terminating in an acute point, the surface of spine with scattered appressed setæ that become longer and more abundant at base of the apical point; mesal edge of spine with a series of serrations. Outer dististyle simple, slightly dilated on basal two-thirds, the apex narrowed; long coarse setæ virtually to the very short apical spine; distal third with a few microscopic appressed denticles. Inner dististyle terminating in a simple cultrate blade, bearing a conspicuous obtuse lobe at base. Ædeagus terminating in a long powerful black spine.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, Rio Pastaza, altitude 1200 metres, September 21, 1937 (*Macintyre*).

Teucholabis (*Teucholabis*) *atripennis* is closest to species such as *T.* (*T.*) *flavithorax* (Wiedemann) and *T.* (*T.*) *schineri* Enderlein, differing conspicuously in the venation, coloration of legs, and structure of the male hypopygium.

Teucholabis (*Teucholabis*) *biramosa*, sp. n.

Size large (wing, ♂, over 8 mm.); mesonotal præscutum dark reddish brown, scutal lobes and scutellum more blackened; halteres dark; legs black, the femoral bases paler; wings strongly suffused with blackish, variegated by more whitish areas near wing-base and before and beyond cord; stigma and a confluent seam on anterior cord darker; male hypopygium with apex of basistyle produced into a bispinous plate; outer dististyle simple.

Male.—Length about 7·5 mm.; wing 8·5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, the verticils much exceeding the segments in length. Head black.

Mesonotum almost uniformly dark reddish brown, the scutal lobes and scutellum more blackened. Pleura reddish brown. Halteres blackened. Legs with the coxæ and trochanters reddish brown; femora black, the femoral bases paler; remainder of legs black; posterior tibiæ with dilation shortly before apex. Wings almost uniformly suffused with blackish, the stigma and a confluent seam on anterior cord darker brown; slightly paler areas at wing-base and before and beyond cord; veins black. Venation: Sc_1 ending about opposite two-thirds the length of Rs, Sc_2 shortly before mid-length of Rs; R_{2+3+4} nearly one-half R_2 alone; cell 1*st* M_2 nearly as long as vein M_{1+2} beyond it.

Abdomen, including hypopygium, black. Male hypopygium with the basistyle relatively slender, at apex produced into a flattened plate that bears an outer straight spine and an inner, shorter, curved spine; face of basistyle on mesal margin bearing a darkened lobe. Outer dististyle a simple dark rod bearing relatively few setæ and scattered spines. Inner dististyle with the outer apical spine very much larger than the inner. Apex of ædeagus produced into a powerful spine.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, Rio Pastaza, altitude 1200 metres, September 21, 1937 (*Macintyre*).

Teucholabis (*Teucholabis*) *biramosa* is most similar to species such as *T.* (*T.*) *flavithorax* (Wiedemann) and *T.* (*T.*) *schineri* Enderlein, differing conspicuously in the venation and the coloration of the legs. Very few known species of the genus have the apical spine of the basistyle bifid, as is the case in the present fly.

Teucholabis (*Teucholabis*) *neoleridensis*, sp. n.

Allied to *leridensis*; general coloration of metathorax polished black; prothorax yellow; knobs of halteres yellow; fore femora chiefly blackened, remaining femora yellow; wings with apical cells weakly infumed; a large oval brown cloud on vein *Cu*, occupying both cells *M* and *Cu*; cell *Sc* chiefly dark; stigma and a narrow seam on cord darkened; *Sc* short, Sc_1 ending just beyond origin of *Rs*; abdomen polished black, the sternites variegated with yellow; male hypopygium with apical spine of basistyle long and slender; outer dististyle with three strong marginal spines on basal portion, the apex broad, terminating in three or four irregular spines; inner dististyle with apical beak relatively narrow, pendulous; ædeagus with apical lobe truncate at apex.

Male.—Length about 5·5 mm.; wing 5·5 mm.

Rostrum brown; palpi black. Antennæ with scape and pedicel brown, flagellum black; flagellar segments oval, relatively stout, the incisures between segments well-demarked. Head dark brown in front, more reddish behind.

Prothorax uniformly yellow. Mesothorax almost uniformly polished black, the restricted humeral region of præscutum and lateral ends of suture a trifle more piceous. Pleura without silvery pubescence. Halteres with stem hairy, dark brown, knob yellow. Legs with all coxæ and trochanters yellow; fore femora chiefly black, the bases restrictedly yellow, fore tibiæ and tarsi black; middle and posterior femora yellow, tibiæ brown, tarsi black. Wings with apical cells weakly infumed, the colour extending posteriorly to the end of vein 1*st A*; stigma darker brown, confluent with a narrow, somewhat paler seam at cord; cell *Sc*, except outer end, dark brown; a large, oval, pale brown cloud on vein *Cu*, involving cells *M* and *Cu*, extending from veins *M* to 1*st A*;

prearcular field restrictedly light yellow; veins dark brown, luteous in the basal portions. Venation: *Sc* short, Sc_1 ending just beyond origin of *Rs*, Sc_2 not far from its tip and nearly opposite origin of *Rs*; cell R_3 strongly widened at outer end by the caudad deflection of vein R_5; *m–cu* just beyond fork of *M*.

Abdomen, including hypopygium, polished black; sternites more variegated with yellow. Male hypopygium with apical spine of basistyle long and slender, subequal in total length to the outer dististyle, gradually narrowed to the acute point; inner margin on basal portion fringed with long delicate setæ. Outer dististyle enlarged on basal half, the inner margin with three strong spinous teeth; apical portion narrower, the tip broad, terminating in three or four irregular spines. Inner dististyle with apical beak relatively narrow, pendulous; a setiferous lobe near base of style on outer face. Ædeagus with apical lobe moderately long, the apex truncated or virtually so.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Baños, altitude 2000 metres, May 25, 1937 (*Macintyre*). *Paratopotypes*, 1 ♂, with the type; 1 sex ?, altitude 1800 metres, June 1936 (*Macintyre*).

Teucholabis (*Teucholabis*) *neoleridensis* is very similar to *T.* (*T.*) *leridensis* Alexander, of northern Panama, but has the male hypopygium entirely distinct. It is evident that there are several allied species confused with the typical form.

Erioptera (*Empeda*) *longifurcata*, sp. n.

General coloration dark brown to brownish black, including the antennæ, halteres and legs; wings very strongly suffused with blackish; Sc_1 ending about opposite mid-length of *Rs*, Sc_2 far from its tip, close to origin of *Rs*; cell R_3 unusually deep, veins R_5 and R_4 lying parallel to one another, R_3 subequal to vein M_4 and nearly one-half longer than *Rs*; male hypopygium with the outer dististyle slender, at beyond mid-length with a small, subacute, lateral branch that is about one-third as long as the apical blade.

Male.—Length about 2·8 mm.; wing 3·5 mm.

Rostrum and palpi black. Antennæ black. Head dull brownish black.

Teucholabis (*Teucholabis*) *biramosa* is most similar to species such as *T.* (*T.*) *flavithorax* (Wiedemann) and *T.* (*T.*) *schineri* Enderlein, differing conspicuously in the venation and the coloration of the legs. Very few known species of the genus have the apical spine of the basistyle bifid, as is the case in the present fly.

Teucholabis (*Teucholabis*) *neoleridensis*, sp. n.

Allied to *leridensis*; general coloration of metathorax polished black; prothorax yellow; knobs of halteres yellow; fore femora chiefly blackened, remaining femora yellow; wings with apical cells weakly infumed; a large oval brown cloud on vein *Cu*, occupying both cells *M* and *Cu*; cell *Sc* chiefly dark; stigma and a narrow seam on cord darkened; *Sc* short, Sc_1 ending just beyond origin of *Rs*; abdomen polished black, the sternites variegated with yellow; male hypopygium with apical spine of basistyle long and slender; outer dististyle with three strong marginal spines on basal portion, the apex broad, terminating in three or four irregular spines; inner dististyle with apical beak relatively narrow, pendulous; ædeagus with apical lobe truncate at apex.

Male.—Length about 5·5 mm.; wing 5·5 mm.

Rostrum brown; palpi black. Antennæ with scape and pedicel brown, flagellum black; flagellar segments oval, relatively stout, the incisures between segments well-demarked. Head dark brown in front, more reddish behind.

Prothorax uniformly yellow. Mesothorax almost uniformly polished black, the restricted humeral region of præscutum and lateral ends of suture a trifle more piceous. Pleura without silvery pubescence. Halteres with stem hairy, dark brown, knob yellow. Legs with all coxæ and trochanters yellow; fore femora chiefly black, the bases restrictedly yellow, fore tibiæ and tarsi black; middle and posterior femora yellow, tibiæ brown, tarsi black. Wings with apical cells weakly infumed, the colour extending posteriorly to the end of vein 1*st A*; stigma darker brown, confluent with a narrow, somewhat paler seam at cord; cell *Sc*, except outer end, dark brown; a large, oval, pale brown cloud on vein *Cu*, involving cells *M* and *Cu*, extending from veins *M* to 1*st A*;

prearcular field restrictedly light yellow; veins dark brown, luteous in the basal portions. Venation: *Sc* short, Sc_1 ending just beyond origin of *Rs*, Sc_2 not far from its tip and nearly opposite origin of *Rs*; cell R_3 strongly widened at outer end by the caudad deflection of vein R_5; *m–cu* just beyond fork of *M*.

Abdomen, including hypopygium, polished black; sternites more variegated with yellow. Male hypopygium with apical spine of basistyle long and slender, subequal in total length to the outer dististyle, gradually narrowed to the acute point; inner margin on basal portion fringed with long delicate setæ. Outer dististyle enlarged on basal half, the inner margin with three strong spinous teeth; apical portion narrower, the tip broad, terminating in three or four irregular spines. Inner dististyle with apical beak relatively narrow, pendulous; a setiferous lobe near base of style on outer face. Ædeagus with apical lobe moderately long, the apex truncated or virtually so.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Baños, altitude 2000 metres, May 25, 1937 (*Macintyre*). *Paratopotypes*, 1 ♂, with the type; 1 sex ?, altitude 1800 metres, June 1936 (*Macintyre*).

Teucholabis (*Teucholabis*) *neoleridensis* is very similar to *T.* (*T.*) *leridensis* Alexander, of northern Panama, but has the male hypopygium entirely distinct. It is evident that there are several allied species confused with the typical form.

Erioptera (*Empeda*) *longifurcata*, sp. n.

General coloration dark brown to brownish black, including the antennæ, halteres and legs; wings very strongly suffused with blackish; Sc_1 ending about opposite mid-length of *Rs*, Sc_2 far from its tip, close to origin of *Rs*; cell R_3 unusually deep, veins R_5 and R_4 lying parallel to one another, R_3 subequal to vein M_4 and nearly one-half longer than *Rs*; male hypopygium with the outer dististyle slender, at beyond mid-length with a small, subacute, lateral branch that is about one-third as long as the apical blade.

Male.—Length about 2·8 mm.; wing 3·5 mm.

Rostrum and palpi black. Antennæ black. Head dull brownish black.

Thorax uniformly dark brown to brownish black. Halteres blackened. Legs with the coxæ dark brown; trochanters obscure yellow; remainder of legs dark brown, provided with setæ and long flattened scales. Wings very strongly suffused with blackish: veins brownish black. All veins beyond cord with complete series of long trichia. Venation: *Sc* moderately long, Sc_1 ending about opposite mid-length of *Rs*, Sc_2 far removed from the tip of Sc_1, close to origin of *Rs*; R_2 oblique, a little shorter than R_{2+3+4}; cell R_3 unusually deep for a member of this subgenus, veins R_3 and R_4 lying parallel to one another, R_3 subequal in length to vein M_4 and nearly one-half longer than *Rs*; *m–cu* at fork of *M*.

Abdomen black, the hypopygium a trifle brighter. Male hypopygium with the outer dististyle a slender blade, at beyond mid-length bearing a small, subacute, lateral branch that is only about one-third as long as the apical blade beyond its insertion. Inner dististyle long and slender, parallel-sided, the tip obtuse.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, Rio Pastaza, altitude 1200 metres, September 21, 1937 (*Macintyre*).

Erioptera (*Empeda*) *longifurcata* much resembles *E.* (*E.*) *stygia* Alexander, in the blackened body-coloration and strongly darkened wings. It is readily told from other regional species of the subgenus by the unusually deep cell R_3 and long vein Sc_1, both characters approaching those of the typical subgenus *Erioptera* to a high degree. It may be noted here that two Argentinian Tipulidæ, originally described as being species of *Rhabdomastix*, *basalis* Alexander and *complicata* Alexander, should be referred to *Empeda*, though aberrant in the normally closed cell 1*st* M_2.

Erioptera (*Erioptera*) *celestis*, sp. n.

General coloration yellow; thoracic pleura with a narrow, dark brown, longitudinal stripe; legs black, the femoral tips pale; legs with an abundant vestiture of flattened scales; wings yellow, with a brown spotted pattern; some of the wing-trichia modified into slightly flattened scales; male hypopygium with two simple dististyles, the outer with two short curved spines.

Male.—Length about 2·5 mm.; wing 3·2 mm.

Rostrum and palpi black. Antennæ black; basal flagellar segments short and crowded, broader than long, passing through cylindrical to long-cylindrical; basal and intermediate flagellar segments with very long verticils that are approximately one-fourth the length of the entire organ; outer three or four segments attenuated, without verticils. Head dark.

Pronotum with a pendant of silvery hairs overlying back of head. Mesonotum uniformly buffy yellow. Pleura yellow, with a narrow but very conspicuous and well-defined darker brown stripe extending from the pronotum to the base of abdomen, passing beneath the root of halteres. Halteres yellow throughout. Legs with the coxæ pale; trochanters darkened; femora black, the tips narrowly pale, the dark colour produced by abundant long flattened scales; tibiæ and basitarsi similarly darkened by black scales, the extreme tips pale; outer tarsal segments paling to yellow. Wings yellow, with a conspicuous brown pattern consisting of small brown spots, distributed as follows: Sc_2; band along cord from tip of Sc_1 to Cu; marginal spots on all veins from R_{1+2} to *2nd A*, excepting R_4, much larger and more conspicuous on R_{1+2} and R_3; a small spot at fork of M_{3+4}; veins yellow, darkened in the clouded areas, the trichia concolorous with the veins. Trichia of veins elongate, in the outer darkened areas more flattened and approaching scales in appearance. Venation: cell M_2 open by atrophy of m; vein *2nd A* relatively sinuous.

Abdomen, including hypopygium, yellow. Male hypopygium with two elongate, simple dististyles; outer style stouter, nearly straight, at distal end a little expanded and provided with two short curved spines; inner dististyle subequal in length or a little longer, appearing as a curved pale blade, at apex on lower margin with about four small tuberlces.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, Rio Pastaza, altitude 1200 metres, April 5, 1937 (*Macintyre*).

The only described near relative is *Erioptera* (*Erioptera*) *lætipleura* Alexander, of southern Mexico, which differs conspicuously in the unpatterned wings and in the structure of the male hypopygium, especially the outer dististyle. The two species form a peculiar isolated group that is perhaps not strictly a member of the restricted subgenus *Erioptera*.

Erioptera (*Mesocyphona*) *caloptera subevanescens*, subsp. n.

Characters as in typical *caloptera* Say, differing in the pattern of the legs. Femora with the dark rings very reduced, especially the outer one, which is about one-half as wide as the pale apex; subbasal ring variable in extent, present or lacking, when preserved much wider than the subterminal ring, the space between the two darkened annuli extensive, being four or five times the width of the outer ring.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 7, 1937 (*MacIntyre*).

Allotopotype, ♀. *Paratopotypes*, 2 ♀♀, April 5–7, 1937.

Cryptolabis (*Cryptolabis*) *laticostata*, sp. n.

Size large (wing, ♀, over 6 mm.); general coloration of notum black; pleura yellow; halteres pale throughout; legs brown, the femoral bases paler; wings bicolorous, strongly infumed, the prearcular field and broad costal margin whitened; *Rs* long and sinuous; abundant macrotrichia in distal half of wing; abdomen dark throughout.

Female.—Length about 5·5 mm.; wing 6·4 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, verticils elongate. Head dull black.

Pronotum dark; anterior lateral pretergites yellow. Mesonotum almost uniformly black, the humeral and posterior regions of præscutum and median area of scutum more reddish brown. Pleura and pleurotergite yellow. Halteres pale throughout. Legs with the coxæ and trochanters yellow; remainder of legs brown, the femoral bases paler. Wings bicolorous, the ground-colour strongly infumed, the broad costal border as far distad as level of cord whitened; prearcular field similarly white; anal cells slightly whitened, the axilla narrowly clouded, connected with the outer ground-colour in cell *M*; veins brown, pale in the whitened areas. Macrotrichia of cells abundant, occupying the distal half of wing.

Venation: *Rs* long and sinuous, exceeding in length vein R_3.

Abdomen dark brown throughout.

Hab. Ecuador (Oriente).

Holotype, ♀, Abitagua, altitude 1200 metres, September 21, 1937 (*Macintyre*).

Cryptolabis (*Cryptolabis*) *laticostata* is very distinct from all previously-described species. It is closest to *C.* (*C.*) *schadei* Alexander, of southern Brazil, but differs conspicuously in the size, and in the pattern of the legs and wings.

XXIV.—*A List of the Type-hosts of the Mallophaga and the Lice described from them* *. By GORDON B. THOMPSON.

[Continued from p. 55.]

Order CICONIIFORMES.

Suborder *ARDEÆ*.

Family **Ardeidæ**.

Subfamily ARDEINÆ.

148. **Ardea cinerea cinerea** Linn.

- Colpocephalum decimfasciatum Boisduval & Lacordaire, 1835. On *Ardea cinerea* from France.
- Colpocephalum importunum Nitzsch in Denny, 1842. On *Ardea cinerea* from Britain.
- Ardeicola ardeæ (Linn.), 1758. On *Ardea cinerea*, no locality.
- Ardeicola leucopyga (Nitzsch in Burmeister), 1838. On *Ardea cinerea*, no locality.
- Ardeicola phœnicopteri (Macalister), 1871, *nec Lipeurus phœnicopteri* Coinde, 1859. True host, described from straggler on *Phœnicopterus ruber* Linn., no locality

149. **Ardea purpurea purpurea** Linn.

- Ardeicola leucoprocta (Nitzsch in Giebel), 1866. On *Ardea purpurea*.

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* *Note.*—It must be borne in mind when using this list that the type-hosts of the various species of Mallophaga are not fixed but only listed.

Ardeicola (leucopyga var.) minor (Piaget), 1880, unjustified new name for *leucoprocta* Nitzsch. On *Ardea purpurea*.

150. **Notophoyx novæhollandiæ** (Latham).

Philopterus longipes (Rudow), 1870. On *Ardea novæhollandiæ*, no locality.

Esthiopterum unguiculatum (Piaget), 1890. Straggler on *Herodias novæhollandiæ*, no locality.

151. **Butorides sundevalli** Reichenow.

Menopon narboroughi * Kellogg & Kuwana, 1902. Straggler (see Procellariidæ, no. 91). On *Butorides plumbeus*, from Narborough I., Galapagos Is.

Degeeriella paludicola † (Kellogg & Kuwana), 1902. Straggler. On *Butorides plumbeus* from Albemarle I., Galapagos I.

152. **Ardeola ralloides** (Scopoli).

Colpocephalum marginatum Macalister, 1871. On *Ardea comata* from South Europe.

Colpocephalum vittatum Rudow, 1866. On *Ardea ralloides*, no locality.

Colpocephalum zonatum Rudow, 1869. Same data.

153. **Ardeola grayii** (Sykes).

Colpocephalum mirzai (Qadri), 1935. On *Ardeola grayii* from North India.

154. **Bubulcus ibis** (Linn.).

Colpocephalum (trochioxum var.) minus Piaget, 1885, *nec* 1880. On *Ardea russata*, no locality (Hyslop coll.).

155. **Casmerodius albus** (Linn.).

Colpocephalum obscurum Giebel, 1874. On *Ardea egretta*, no locality.

Rallicola acuminata (Piaget), 1885. On *Ardea egretta*, no locality. ? Straggler; see Rallidæ later.

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* Also described from a female specimen taken from *Puffinus lherminieri subalaris* Ridgway (*Puffinus subalaris*), which I take to be the true host.

† The true host of this species is almost certainly one of the Laridæ.

156. **Casmerodius albus egretta** (Gmelin).

Colpocephalum laticeps Kellogg, 1896. On *Ardea egretta* from Kansas, U.S.A.

157. **Casmerodius albus modestus** (J. E. Gray).

Menopon sulcatum Piaget, 1880. On *Ardea egretta*, no locality (Leyden Mus.), probably from Java.

Rallicola bipustulata (Piaget), 1880. On *Ardea egretta* from Java. ? Straggler ; see Rallidæ later.

158. **Casmerodius albus melanorhynchus** (Wagler).

Colpocephalum oreas Kellogg, 1908. Straggler ; see Ciconiinæ, no. 183). On *Herodias alba* * from Kilimandjaro-Meru, Natron Lakes.

Colpocephalum veratrum Kellogg, 1908. On *Ardea (Herodias) alba* from Kilimandjaro-Meru, Natron Lakes.

159. **Egretta garzetta** (Linn.).

Myrsidea kikuchii Uchida, 1918. On *Egretta garzetta garzetta* from Formosa. Straggler, probably from Passerine.

Colpocephalum (importunum var.) majus Piaget, 1880, p. 549, *nec* p. 519. On *Ardea garcetta*, no locality.

160. **Demigretta sacra** (Gmelin).

Ardeicola (signata var.) pallida (Piaget), 1880, *nec Lipeurus pallidus* Giebel, 1866. On *Ardea albolineata* from Celebes.

161. **Nycticorax nycticorax nycticorax** (Linn.).

Colpocephalum nyctarde Denny, 1842. On *Ardea nycticorax* from Britain.

Colpocephalum tamamurensis Uchida, 1926. On *Nycticorax n. nycticorax* from Japan.

162. **Nycticorax caledonicus minahassæ** Meyer & Wiglesworth.

Ardeicola atrata (Piaget), 1880. On *Ardea caledonica* from Celebes.

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* Also stragglers on *Aplopelia larvata larvata* (Temminck).

163. **Tigriornis leucolopha** (Jardine).

Menopon planiceps Piaget, 1885. On *Ardea leucolopha*, Leyden Mus.

164. **Ardea** (s. l.) sp. ?

? Sæmundssonia producta (Piaget), 1880. On *Ardea* sp. from Java. Straggler; probable true host a Charadriiform.

Subfamily BOTAURINÆ.

165. **Ixobrychus minutus** (Linn.).

Philopterus sulcatus (Piaget), 1888. On *Ardea minuta*.

166. **Ixobrychus sturmii** (Wagler).

Colpocephalum xenicum Kellogg, 1908. On *Ardea* (*Ardetta*) *sturmi* from Kilimandjaro Meru, Natron Lakes.

167. **Botaurus stellaris** (Linn.).

Colpocephalum trochioxum Nitzsch in Burmeister, 1838. On *Ardea stellaris*.

[Læmobothrion gilvum Burmeister in Denny, 1842. On *Ardea stellaris*, almost certainly straggler, unique type in bad condition in 1874.]

Philopterus ovatus (Giebel), 1874. On *Ardea stellaris*.

Ardeicola stellaris (Denny), 1842. On *Ardea stellaris* from Britain.

Ardeicola fasciata (Piaget), 1880, unjustified *nom. nov.* for *stellaris* Denny. On *Ardea stellaris*.

168. **Botaurus lentiginosus** (Montagu).

Ardeicola botauri (Osborn), 1896. On *Botaurus lentiginosus* [from U.S.A.].

Suborder *CICONIÆ*.

Superfamily **SCOPOIDEA**.

Family **Scopidæ**.

169. **Scopus umbretta bannermani** C. H. B. Grant.

Menopon madagascariense Mjöberg, 1910. On *Scopus umbretta* from Madagascar.

Colpocephalum scopinum Mjöberg, 1910. Same data.

Degeeriella umbrina (Nitzsch in Giebel), 1866. On *Scopus umbretta*.

Superfamily **CICONIOIDEA**.

Family **Ciconiidæ**.

Subfamily MYCTERIINÆ.

170. **Mycteria americana** Linn.

Menopon maculipes Giebel, 1874. On *Tantalus loculator*.

Colpocephalum femoratum Piaget, 1885. On *Mycteria americana*, Hyslop coll.

Colpocephalum scalariforme Rudow, 1866. On *Tantalus loculator*.

Neophilopterus heteropygus (Nitzsch in Giebel), 1874. On dry skin of *Tantalus loculator* in Berlin.

Ardeicola linearis (Rudow), 1869, *nec Lipeurus linearis* Nitzsch, 1866. On *Tantalus loculator*.

Ardeicola loculator (Giebel), 1874. On dry skin of *Tantalus loculator* in Berlin.

171. **Ibis leucocephalus** (Pennant).

Degeeriella trimaculata (Piaget), 1880. On *Ciconia leucocephala* * from Celebes. ? Straggler.

Ardeicola castanea (Piaget), 1885. On *Ciconia leucocephala* in Leyden Mus.

Esthiopterum (? Ardeicola) tantali (Fabricius), 1798. On *Tantalus leucocephalus*.

172. **Ibis cinereus** (Raffles).

Neophilopterus indicus (Piaget), 1880. On *Tantalus lacteus* from Java.

Ardeicola prælonga (Piaget), 1880. Same data.

Subfamily CICONIINÆ.

173. **Anastomus oscitans** (Boddaert).

Colpocephalum occipitale Nitzsch in Giebel, 1866. On *Anastomus coromandelicus* in Paris (? Mus.).

Neophilopterus completus (Nitzsch in Giebel), 1866. Same data.

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* In view of the locality this was probably *Ibis cinereus* (Raffles) (see no. 172), and this may also apply in the case of *A. castanea* (Piaget).

Ardeicola lepida (Nitzsch in Giebel), 1866. Same data.

174. **Anastomus lamelligerus** Temminck.

Ardeicola signata (Piaget), 1880. On *Anastomus lamelligerus*, Leyden Mus

175. **Anastomus lamelligerus madagascariensis** Milne-Edwards.

Neophilopterus platyclypeatus (Piaget), 1871. On *Anastomus lamelligerus* from Madagascar.

176. **Sphenorhynchus abdimii** (Lichtenstein).

Neophilopterus abdimius Bedford, 1929. On *Sphenorhynchus abdimi* from S.W. Africa.

177. **Dissoura episcopus microscelis** (G. R. Gray).

Neophilopterus episcopi (Kellogg), 1908. On *Dissoura* * *episcopus* or *microscelis* from Kilimandjaro-Meru, Natron Lakes.

178. **Dissoura episcopus episcopus** (Boddaert).

Colpocephalum uchidi Qadri, 1936. On *Dissoura episcopa* from North India.
Ardeicola episcopi (Qadri), 1936. Same data.

179. **Ciconia ciconia ciconia** (Linn.).

Colpocephalum quadripustulatum Nitzsch in Burmeister, 1838. On *Ciconia alba* from Germany.
Colpocephalum zebra Nitzsch in Burmeister, 1838. Same data.
Neophilopterus incompletus (Nitzsch in Denny), 1842. On *Ciconia alba* from England.
? Ardeicola ardealis (Scopoli) †, 1763. On *Ardea ciconia*.
Ardeicola ciconiæ (Linn.), 1758. On *Ardea ciconia*.
Ardeicola versicolor Nitzsch, 1818, *nom. nud.* for *ciconiæ* Linn. On *Ciconia alba*.

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* Also stragglers on *Casmerodius albus melanorhynchos* (Wagler) (*Herodias alba*) and *Ephippiorhynchus* (*senegalensis* Shaw). The females from the second host may have been *N. bicolor* (Piaget).

† This may be a species of *Neophilopterus*, in which case it is probably the same as *N. incompletus* (Nitzsch in Denny).

180. **Ciconia nigra** (Linn.).

Colpocephalum ferrisi Bedford, 1930. On *Melanopelargus niger* from S.W. Africa.

Neophilopterus tricolor (Nitzsch in Burmeister), 1838. On *Ciconia niger* from (?) Germany.

Ardeicola maculata (Nitzsch in Giebel), 1866. On *Ciconia nigra* from (?) Germany.

Ardeicola variegata (Neumann), 1912. On *Ciconia nigra* from Abyssinia *.

181. **Euxenura galeata** (Molina).

Neophilopterus subincompletus (Nitzsch in Giebel), 1866. On *Ciconia maguari.*

182. **Xenorhynchus asiaticus australis** (Shaw).

Philopterus horridus † (Giebel), 1876. On *Ciconia* (*Mycteria*) *australis.*

183. **Ephippiorhynchus senegalensis** (Shaw).

Colpocephalum ephippiorhynchi Mjöberg, 1910. On *Ephippiorhynchus senegalensis* from Sudan.

Colpocephalum oreas Kellogg, 1908. On *Ephippiorhynchus senegalensis* ‡ from Kilimandjaro-Meru, Natron Lakes.

Colpocephalum subflavescens Piaget, 1880. On *Xenorhynchus senegalensis*, Rotterdam Zoo.

Colpocephalum tibiale Piaget, 1888. On *Tantalus senegalensis*, Trouessart Coll.

Rallicola turbinata (Piaget), 1890 (? straggler; see Rallidæ, later). On *Mycteria senegalensis*, Trouessart Coll.

Ardeicola bicolor (Piaget), 1888. On *Tantalus senegalensis*, Trouessart Coll.

184. **Leptoptilos dubius** (Gmelin) §.

Menopon temporale Piaget, 1880. On *Leptoptilus argala* §, Rotterdam Zoo.

Colpocephalum eurygaster Piaget, 1888. On *Leptoptilus argala* §. Trouessart Coll.

---

* Also stragglers on *Gypaetus barbatus* (Linn.) and *Melittophagus variegatus.*

† This may be a *Neophilopterus.*

‡ Also stragglers on *Casmerodius albus melanorhynchos* (Wagler) and *Aplopelia larvata larvata* (Temminck).

§ This is only a tentative suggestion for the type-host. See also no. 204. I understand that at the time the name *argala* was in use both the species of *Leptoptilus* were known by this name.

185. **Leptoptilos crumeniferus** (Lesson).

Colpocephalum longissimum Rudow, 1869. On *Leptoptilus crumenifer.*
Ardeicola fissomaculata (Giebel), 1874. On *Mycteria crumenifera.*
Ardeicola genitalis (Piaget), 1885. On *Leptoptilus crumenifer*, Amsterdam Zoo.

186. **Ciconiidæ**, gen. et sp. ?

Neophilopterus unifasciatus (Piaget)*, 1885. Straggler on *Polyborus vulgaris*, Leyden Mus.

Superfamily THRESKIORNITHOIDEA.

Family Threskiornithidæ.

Subfamily THRESKIORNITHINÆ.

187. **Threskiornis æthiopica æthiopica** (Latham).

Colpocephalum leptopygos Nitzsch in Giebel, 1874. On *Ibis sacra* †, no locality.
Colpocephalum pygidiale Mjöberg, 1910. On *Ibis religiosa* (corrected in same paper to *I. æthiopica,* no locality, Mus. Göteb).
Philopterus foudrasi (Coinde), 1859. On *Ibis sacra* †, no locality.
Ibidœcus threskiornis Bedford, 1929. On *Threskiornis æthiopica* from Zululand, S. Africa.
Degeeriella sacra (Giebel), 1866. On *Ibis sacra* †. Almost certainly a straggler, probably true host is a Charadriiform.

188. **Threskiornis melanocephala** (Latham).

Ibidœcus clausus (Giebel), 1874. On *Ibis macei.*

189. **Threskiornis molucca strictipennis** (Gould).

Ardeicola ibis Le Souëf & Bullen, 1902. On *Threskiornis strictipennis* from Australia.

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* Piaget himself recognised this species as a Stork parasite.

† The interpretation of this host is doubtful. The " Sacred Ibis " is *Threskiornis æthiopica* (Latham), and the name *Ibis sacra* may be a mere rendering of Sacred Ibis into Latin. According to some ornithologists *Ibis sacra*=*Plegadis f. falcinellus* (Linn.) (see no. 199).

190. **Geronticus eremita** (Linn.).

Ibidœcus vicinus (Neumann), 1922. On *Comatibis comata* from Abyssinia.

Ardeicola exilis (Neumann), 1913, *nom. nov.* for *Lipeurus gracilis* Neumann, 1912, *nec* Packard, 1870. On *Comatibis comata* from Abyssinia.

191. **Lampribis olivacea** (Du Bus).

Eulæmobothrion pallescens (Kellogg), 1908, *nom. nov.* for *Læmobothrion pallidum* Piaget, 1885, *nec* Giebel, 1874. On *Ibis olivacea*, Leyden Mus.

192. **Hagedashia hagedash** (Latham).

Colpocephalum subpenicillatum Piaget, 1885. On *Ibis hagedasch*, Leyden Mus.

Ardeicola capitata (Piaget) *, 1885. Same data.

193. **Hagedashia hagedash hagedash** (Latham).

Eulæmobothrion kelloggi (Bedford), 1919, *nom. nov.* for *Læmobothrion africanum* Kellogg & Ferris, 1915, *nec* Kellogg, 1908. On *Theristicus hagedash* from Zululand, S. Africa.

194. **Theristicus caudatus** (Boddaert).

Menopon mamillatum Piaget, 1885. On *Theristicus caudatus*, no locality (Hyslop Coll.).

Colpocephalum trispinum Piaget, 1885. Same data.

Ardeicola theristicum (Pessôa & Guimarães), 1935. On *Theristicus caudatus* (Bodd.) from Matto-Grosso, Brazil.

195. **Theristicus branickii** Berlepsch & Stolzmann.

Ibidœcus fissisignatus (Kellogg & Paine), 1911. On " Desert Curlew " from Bolivia.

Ardeicola epiphanes (Kellog & Paine), 1911. Same data.

196. **Mesembrinibis cayennensis** (Gmelin).

Eulæmobothrion setigerum (Piaget), 1889. On *Ibis cayennensis*, no locality.

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* Clay, 1935, gives the type-host of this species as *Hagedashia hagedash nilotica* Neumann, but I can see no justification for this.

197. **Guara alba** (Linn.).

Colpocephalum fusconigrum Giebel, 1874. On *Ibis alba*, no locality.

198. **Guara rubra** (Linn.).

Philopterus furcatus * (Giebel), 1874. On *Ibis rubra.*

Ibidœcus hians (Giebel), 1874. On *Ibis rubra.*

Ardeicola gracilenta (Piaget), 1888. On *Ibis rubra*, no locality.

199. **Plegadis falcinellus falcinellus** (Linn.).

Ibidœcus bisignatus (Nitzsch in Giebel), 1866. On *Ibis falcinellus*, Naumann Coll.

Ardeicola pseudoraphidia (Taschenberg), 1882 (part; see no. 202), *nom. nov.* for *Lipeurus raphidius* Piaget, 1880, *nec* Nitzsch, 1866. On *Ibis falcinellus* †, Leyden Mus.

Ardeicola raphidia (Nitzsch in Giebel), 1866. On *Ibis falcinellus*, no locality.

200. **Plegadis falcinellus peregrinus** (Bonaparte).

Philopterus emarginatus (Piaget), 1871. On *Ibis peregrina*, no locality.

201. **Plegadis guarauna** (Linn.).

Ardeicola argentina (Kellogg), 1906. On *Plegadis guarauna* from Argentina.

202. **Lophotibis cristata** (Boddaert).

Colpocephalum penicillatum Piaget, 1880. On *Ibis cristata*, Leyden Mus.

Ardeicola pseudoraphidia (Taschenberg), 1882, *nom. nov.* for *Lipeurus raphidius* Piaget, 1880, *nec* Nitzch, 1866 (part; see no. 199). On *Ibis cristata* ‡, Leyden Mus.

203. **From undetermined Ibises.**

Ibidœcus acutulus (Neumann), 1922. On "Ibis," no locality, Hyslop Coll.

Ibidœcus bimaculatus (Mjöberg), 1910. On *Ibis* sp. from South America.

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* This may be an *Ibidœcus*.

† The specimens from this host are apparently not those on which the description was chiefly based; see no. 202.

‡ This host is probably the correct one.

204. **Probably from Ibises.** Species described from stragglers, etc.

Ibidœcus breviloratus (Nitzsch in Giebel), 1866. On dry skin of *Ciconia argala* * at Frankfort.

Ibidœcus robustus Qadri, 1935. On "a water-bird" † from North India.

Ibidœcus longiclypeatus (Piaget), 1885. Straggler on "*Sittace macao*," Leyden Mus.

Ibidœcus piageti (Bezzi), 1890, *nom. nov.* for *bisignatus* Piaget, 1885, *nec* Nitzsch, 1866. Same data.

Ardeicola macroceros (Piaget), 1885. Straggler on "*Milvago pezoporus*," Amsterdam Zoo.

Subfamily PLATALEINÆ.

205. **Platalea leucorodia** Linn.

Menopon atrofulvum Piaget, 1880. On *Platalea leucorodia*, no locality.

Actornithophilus gracilis (Piaget)‡, 1880. Same data.

Ibidœcus plataleæ (Denny), 1842. On *Platalea leucorodia* from England.

Ibidœcus sphenophorus (Nitzsch in Giebel), 1866. On *Platalea leucorodia*.

? Degeeriella dentata (Mjöberg), 1910. On *Platalea* sp. "Stuxberg coll." (*i. e.*, Arctica).

Ardeicola plataleæ (Linn.), 1758. On *Platalea leucorodia*.

Ardeicola platalearum (Giebel), 1866. On *Platalea leucorodia* § from Holland.

206. **Platalea alba** Scopoli.

Eucolpocephalum robustum Bedford, 1930. On *Platalea alba* from Cape Province, S. Africa.

207. **Platalea flavipes** (Gould).

Ibidœcus flavus Cummings, 1916. On *Platibis flavipes* from Victoria, Australia.

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* See no. 184 for notes on this host name.

† The true host of this species may be one of the following birds :— *Threskiornis melanocephala* (Latham), *Plegadis falcinellus* (Linn.), *Platalea leucorodia major* Temminck & Schlegel.

‡ If this species is an *Actornithophilus* it must be a straggler.

§ Giebel also mentions specimens from *P. ajlaja*, but states that they had been lost.

208. **Ajaia ajaja** (Linn.).

Colpocephalum ajajæ Ewing, 1930. On *Ajaja ajaja* from Texas, U.S.A.

209. **On Ciconiiformes**—true hosts not known.

Ardeicola porrecta (Piaget), 1890. Straggler on *Buceros bicornis*, Trouessart Coll.
Ardeicola saturatior (Piaget), 1890. Straggler on *Tochus erythrorhynchus*, Trouessart Coll.

Suborder *PHŒNICOPTERI* Temminck.

Family **Phœnicopteridæ.**

210. **Phœnicopterus antiquorum** Temminck.

Colpocephalum heterosoma Piaget, 1880. On *Phœnicopterus antiquorum*, Rotterdam Zoo.
Trinoton femoratum Piaget, 1880. Same data.
Philopterus phœnicopterus (Mjöberg), 1910. On *Phœnicopterus roseus*, Copenhagen Zoo.
Philopterus pilosus (Piaget), 1880. On *Phœnicopterus antiquorum.*
Philopterus pygaspis (Nitzsch in Giebel), 1866. On *Phœnicopterus antiquorum.*
Anaticola phœnicopteræ * (Coinde), 1859. On "Flamants de Nubie—Indie, Gulf Babel Mandeb."
Anaticola subsignata (Giebel), 1866. On *Phœnicopterus antiquorum* from Berlin (Zoo or Museum ?).
Anaticola trapezoidea (Rudow), 1869. On *Phœnicopterus antiquorum*, no locality.
(Ardeicola phœnicopteri (Macalister), 1871. Straggler. See no. 148.)

211. **Phœnicopterus ruber** Linn.

Anaticola candida (Rudow), 1869. On *Phœnicopterus ruber.*

[To be continued.]

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* The name given to this species in the original is "*Lipeurus phænicopteræ.*"

XXV.—*Notes on the Herpetology of the East African Islands.* By H. W. PARKER, R. E. MOREAU, and R. H. W. PAKENHAM.

IN preparation for a check-list of the vertebrates of the East African islands, Pemba, Zanzibar and Mafia, past compilations by Voeltzkow (1923), Loveridge (1923, 1924, 1930) and Pitman (1938) have been examined critically. Several forms admitted therein to one or other of the insular lists have had to be rejected, and it seems desirable that the reasons should be placed on record. As regards Zanzibar, there is, of course, the standing difficulty that up to about 1887 the name was applied not only to the island, but to the coastal strip of the mainland that was more or less subject to the authority of the Sultan. Sometimes the fact that a specimen, attributed to "Zanzibar" in a list, did not come from the island can be established by examining the original label or museum-register entry; but after all such efforts it may be suspected that the Zanzibar Island list will remain unduly augmented by records actually derived from the mainland.

Many of the nominal species appearing in the papers referred to have subsequently been shown to be synonyms or misidentifications, and a number of others are almost certainly based on specimens with incorrect localities. For the convenience of those who have no facilities for consulting the scattered literature, the names now believed to be synonyms and those based on erroneous identifications are given, as well as the reasons which lead us to reject certain other records.

I. *Nominal Species now Regarded as Synonyms or Misidentifications.*

SAURIA.

Phelsuma laticauda Boettger. This species is recorded from Zanzibar by Loveridge (1923, 1924), *P. dubium* Boettger being placed as a synonym. But Tornier (1902), after examining co-types of both, asserts that the two are distinct and that the form occurring on Zanzibar is *P. dubium*. The most recent worker on the genus (Rendahl, 1939, p. 264) accepts the latter view.

Lygodactylus capensis (Smith), reported from Mafia by Parker, is based on incorrectly identified specimens of *L. grotei* Sternfeld

Varanus albigularis (Daudin) and *V. ocellatus* Ruppel are both recorded in the insular fauna of Zanzibar by Loveridge (1923, p. 11), but other authors mention only the first-named. There is probably only the one species of large-scaled Monitor upon the island, but which name should be used for it is still uncertain.

Chamæleon angusticoronatus Barbour=*C. dilepis dilepis* Leach. Loveridge *in litt.*

Mabuya albotæniata Boettger, described from Pemba, is regarded by Barbour & Loveridge (1928) as a synonym of *M. maculilabris* (Gray).

Mabuya comorensis (Peters) is considered by Loveridge (1933) to be, at most, a subspecies of *M. maculilabris* (Gray). Specimens with the characteristics of both are found in Zanzibar, so that, until their taxonomy has been cleared up, it seems best to record both under the oldest name, *maculilabris*.

SERPENTES.

Boodon lineatus var. *bipræocularis* Günther=*Boædon lineatus* Dum. & Bibr. (Boulenger, 1893, p. 332).

Boodon lineatus var. *quadrilineatus* Dumeril=*B. lineatus* Dum. & Bibr. (Boulenger, *loc. cit.*).

Lycophidium jacksoni Boulenger, recorded by Voeltzkow from Pemba, is a synonym of *L. capense* Smith (Loveridge, 1929, p. 20).

Lycophidion capense Smith, from Zanzibar, is said to belong to a recognisable subspecies *L. capense acutirostre* Günther (Loveridge, 1933, p. 234, 1937, p. 493).

Philothamnus thomensis (Bocage) has been included among the snakes of Zanzibar on account of Pfeffer's (1893, p. 84) reference, which reads as follows :—

" *Philothamnus punctatus* Peters var. *thomensis* Barboza du Bocage spec. Ein Stuck von Jambiani, welches durchaus zu den vorigen Stücken gehört, ist von *Ph. thomensis* Barb. (*l. c.*, p. 11) nicht zu unterscheiden." The " vorigen Stücken " had, on the previous page, been made the cotypes of *Philothamnus punctatus* var. *sansibaricus*. It is obvious that Pfeffer was not using the " var." in any subspecific sense, since specimens from the same locality which " belonged " to one another were being referred to two distinct "vars." *P. punctatus* var. *sansibaricus* has been generally regarded as a synonym of *P. semivariegatus* (Smith), and it seems probable that the identification of the single, odd, Jambiani specimen with *thomensis* was erroneous; if it "belonged" to the other specimens it must, presumably, have been a *semivariegatus* also.

Elapechis niger (Günther) is a synonym of *Elapsoidea* [*Elapechis*] *guentheri* Bocage, q. v. *infra* (Barbour & Loveridge, 1928, p. 134).

Atractaspis rostrata Günther has been placed in the synonymy of *Atractaspis bibroni* Smith (Werner, 1913).

AMPHIBIA.

Rappia fulvovittata Cope, recorded by Voeltzkow from Zanzibar, is believed to have been based on incorrectly identified specimens of *Megalixalus brachycnemis* Boul. (Loveridge, 1929, p. 114).

Hyperolius melanophthalmus Ahl=*H. mariæ* Barbour & Loveridge (Loveridge, 1936, p. 398).

Hyperolius renschi Ahl=*H. mariæ* Barbour & Loveridge (Loveridge, *loc. cit.*).

Arthroleptis scheffleri Nieden=*A. minutus* Boul. (Loveridge, 1930 & 1936, p. 421).

Hemisus sudanense Steindachner = *H. marmoratum* (Peters) (Boulenger, 1910, Noble, 1924).

II. *Incorrect Locality Records.*

AMPHIBIA.

Bufo taitanus appears in Voeltzkow's list under the heading Mafia. The specimens were really collected on Songosongo, many miles to the south (Boettger, 1913, p. 345).

TESTUDINES.

Pelusios nigricans (Donndorff) is recorded by Loveridge (1924) from "Zanzibar." The only definite insular record traced is for Pemba, and it seems probable that "Zanzibar" was used in the sense of the Protectorate and not of the island.

Kinixys belliana Gray is also recorded from Zanzibar by Loveridge (*loc. cit.*), apparently on the basis of a single juvenile specimen presented to the British Museum in 1893 by Frank Finn, who made a short stay on the island (*cf.* Ibis, 1893, pp. 223–234), and another in the Museum, of Comparative Zoology, Harvard, collected probably by Caleb Cook. The species has not since been reported, and it may be suspected that the specimens are not insular.

SERPENTES.

Typhlops lumbriciformis (Peters) was originally described from the Zanzibar Coast, and Boulenger (1893, p. 55) records another specimen from "Zanzibar." Actually at the time it was received the specimen was registered as from "Comoro" and the bottle labelled "East Africa." The locality "Zanzibar" is a later intercalation, and, since the species has not been found on the island, can be neglected.

Typhlops unitæniatus (Peters) is also recorded from Zanzibar on the basis of a statement by Boulenger (1893, p. 55). But the species, which was originally described from Taita, has never actually been recorded from the island, and it seems that Boulenger's "Zanzibar" included Mombasa, from which he had a specimen.

Simocephalus poensis (Smith), included by Voeltzkow among the Zanzibar fauna, is probably based on an incorrectly identified specimen of *S. capensis capensis* (A. Smith) which, in any event, was probably collected in the Usambara region of Tanganyika Territory (Loveridge *in. litt.*). The only *Simocephalus* (=*Mehelya*) known definitely to occur on Zanzibar is *M. nyassæ* (Günther).

Boodon infernalis Dum. & Bibr., now referred to the genus *Lamprophis*, has repeatedly been included as a Zanzibar species on the basis of two specimens said to have come from there and presented to the British Museum by Speke. The species is otherwise known only from South Africa, and it seems very improbable that the record can be correct. The specimens were actually received in London a year before Speke's main East African collections, which makes it seem possible that they were obtained from some other source.

Coronella semiornata (Peters). The basis of the continued records of this species appears to be the specimen, mentioned on p. 196 of the second volume of the Catalogue of Snakes in the British Museum, from the "Coast of Zanzibar." Actually the specimen itself is labelled "Mainland opposite Zanzibar."

Tarbophis semiannulatus (A. Smith) is also included as a Zanzibar snake on the basis of a specimen in the British Museum (Cat. iii. p. 52) from the "Zanzibar Coast," *i. e.*, mainland.

Dipsadomorphus blandingi Hallowell, *Dromophis lineatus* Dum. & Bibr., and *Chlorophis heterolepidotus* (Günther) are recorded from Zanzibar on the basis of specimens in the British Museum labelled "Zanzibar Coast" or "Coast of Zanzibar," and must all be accounted mainland records.

Elapsoidea [*Elapechis*] *guentheri* Bocage has been recorded from Zanzibar, since the type of *E. niger* Günther, a synonym, was said to have come from "Ushambola, Zanzibar." But Ushambola appears to be only an archaic spelling of Usambara, which is not insular.

Bothrophthalmus lineatus Peters, was recorded accidentally from Zanzibar by Loveridge (1924), as Pitman (1938, p. 302) has already pointed out.

Bitis gabonica (Dum. & Bibr.) has been recorded from Zanzibar by Loveridge (1924, p. 8), Voeltzkow (p. 304), and Pitman (p. 270), but not by Boettger. The basis of these records may be the specimen from "Ushambola, Zanzibar," mentioned in the Catalogue of Snakes in the British Museum (iii. p. 500)—if so, the record is mainland, not insular.

Atractaspis irregularis (Reinhardt) is reported from Zanzibar by the same three authors as the foregoing, but is also not included by Boettger. Possibly the records are based on the examples from the Zanzibar Coast reported by Tornier (1897).

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XXVI.—*Notes on Mosquitoes.*

By F. W. Edwards and H. E. Box.

I. *Systematic.* By F. W. Edwards.

Records and observations on mosquitoes in the island of Antigua have hitherto been few and far between. In the year 1901 two species ("*Tæniorhynchus*" *niger* Giles and *Grabhamia pygmæa* Theobald) were described from specimens collected on the island by a resident naturalist, Mr. W. R. Forrest, who also found *Anopheles albimanus* Wied., and the two Tropicopolitan domestic species *Aëdes ægypti* L. and *Culex fatigans* Wied. Apparently no species other than these have been recorded in print as occurring on Antigua, but in a small collection presented to the British Museum by Mr. Forrest in 1931, two more were represented; these I have now determined as *Culex bahamensis* D. & K. and *C. habilitator* D. & K.

During 1938, a collection of mosquitoes was made in Antigua by Mr. H. E. Box, who found eight species in addition to the seven previously obtained by Mr. Forrest. Mr. Box's collection has been presented to the British Museum through the Imperial Institute of Entomology, and forms the main basis of the following notes.

The full list of Antigua mosquitoes now known, with their known range outside the island, is as follows:—

Anopheles (*Nyssorhynchus*) *albimanus* Wied. Florida and Texas to Venezuela; Jamaica, Porto Rico.
Anopheles (*N.*) *tarsimaculatus* auct. Central America and Lesser Antilles to Paraguay.
Anopheles (*N.*) *argyritarsis* R.-D. Mexico to Northern Argentina; Windward Is.
Psorophora (*Grabhamia*) *pygmæa* Theo. Florida Keys, Bahamas, Jamaica.

Aëdes (*Ochlerotatus*) *tæniorhynchus* Weid. var *niger* Giles. S. Florida and Jamaica to St. Lucia and Barbados.
Aëdes (*Stegomyia*) *ægypti* L. Tropicopolitan.
Culex (*Culex*) *bahamensis* Dyar & Knab. Bahamas and Virgin Is.
Culex (*C.*) *habilitator* D. & K. Santo Domingo, Virgin Is.
Culex (*C.*) *declarator* D. & K. Texas to Brazil, Lesser Antilles.
Culex (*C.*) *fatigans* Wied. Tropicopolitan.
Culex (*C.*) *nigripalpus* Theo. Florida to Brazil, Bahamas, Antilles.
Culex (*Micraëdes*) *americanus* N.-L. Guadeloupe, Porto Rico, Santo Domingo.
Culex (*Melanoconion*) *elevator* D. & K. Costa Rica, Panama, Brazil.
Culex (*M.*) *atratus* Theo. Jamaica, Virgin Is., Barbados(?).
Deinocerites cancer Theo. Coasts of Florida, Mexico, Antilles, C. America.

The absence of any species of the genus *Wyeomyia*, or of the subgenus *Janthinosoma*, is noteworthy.

Culex (*Culex*) *bahamensis* D. & K.

The remarkable hypopygium of this species renders its identity unmistakeable from the description alone, but the determination has been confirmed by comparison with specimens named by Dyar.

Dyar described the hind tibia as having a pale stripe "within"; actually there is a conspicuous pale stripe on the anterior surface of the hind tibia and another on the posterior surface, the tibia being dark above and below; there is also a less conspicuous pale stripe on anterior surface of middle tibia; these markings will serve to distinguish the species from most others which are somewhat similar. In most specimens examined, two or three lower mesepimeral bristles are present instead of the usual one. As usual in this subgenus, acrostichal bristles are well developed and almost as long as the rather short dorso-centrals.

Culex (*Culex*) *habilitator* D. & K.

Another species with extremely distinctive hypopygium; the identity of the Antigua specimens established by comparison with specimens named by Dyar.

One of the most striking features of the male is not mentioned in the published descriptions; this is the extraordinary length of many of the hairs on the coxites, these hairs being about one-third as long as the abdomen and curled at the tips, forming a pair of loose tufts which are very conspicuous under a hand-lens; no other American *Culex* known to me is similarly adorned. In addition, each coxite has a small tuft of hair at the base, and another peculiarity is that the terminal spine of the style is very long and curved.

Culex (*Micraëdes*) *americanus* N.-L.

Dyar placed this species in the subgenus *Melanoconion* on account of the slender, tapering male style; in my 'Genera Insectorum' catalogue I recognised *Micraëdes* as a valid subgenus, largely on account of the form of the palpi (one-third the length of the proboscis in both sexes), and on account of the habitat of the larva (leaf-axils of Bromeliaceæ) suggested that the subgenus might be nearer to *Microculex* than to *Melanoconion*. It now appears that a relationship to *Microculex* can be seen in the mesonotal bristles: in *C. americanus*, as well as in *C. imitator* and several other (though not all) species of *Microculex*, distinct acrostichal bristles are present, whereas in most, if not all species of *Melanoconion* (sens. lat.) such bristles are absent.

The most striking feature of the larva is the presence of numerous short dense hair-tufts on the abdomen, reminiscent of many plant-breeding species of the Sabethine genera *Wyeomyia* or *Tripteroides*. and very unusual for a *Culex*. This development, however, can hardly be regarded as a specialisation for life in *Bromelia* leaf-axils, as it does not occur in the subgenus *Microculex*.

Dyar distinguished two nearly-allied species: *C. americanus* in the Lesser Antilles (Guadeloupe, Porto Rico, and Santo Domingo) and *C. antillum-magnorum* in the Greater Antilles. Although this distinction has been upheld by Komp, the single distinguishing feature given appears to me of questionable value. The specimen, of which I mounted the hypopygium, showed only one distinct spine on the proximal division of the coxite-lobe, and would thus agree rather with *C. antillum-magnorum* than with *C. americanus*; but no material is available for comparison with the Antigua series.

Culex (*Melanoconion*) *atratus* Theo.

The figure of the hypopygium of this species given by Howard, Dyar, and Knab, and repeated by Dyar, is very poor and inaccurate. Mounts of typical specimens from Jamaica show that in between the proximal and distal divisions of the coxite lobe (which are very slightly developed and widely separated) is a group of four or five flattened bristles (or narrow, pointed, unstriated scales); the lobes of the ninth tergite are pointed. Males from Antigua agree precisely with those from Jamaica.

As in other species of the subgenus *Melanoconion* (sens. lat.) the dorso-central bristles of the mesonotum are long, but acrostichals are absent, except for a very few on the front margin.

Culex (*Melanoconion*) *elevator* D. & K.

The specimens mounted agree with Dyar's description of *C. curryi* Dyar, which Komp (1935) considers to be a synonym of *elevator*. Previous records of *C. elevator* (*curryi*) are from Costa Rica, Panama, and Brazil, but some others of Dyar's species are perhaps synonyms, and if so the recorded range may be more extensive. Another species of the same group (*C. madinenensis* Senevet) has been recorded from Martinique.

II. *Field Notes* *. By Harold E. Box.

During the months of September and October, 1938, the writer made a collection of mosquitoes in Antigua, consisting for the most part of adults reared from larvæ in various habitats covering the principal ecological zones of the island. Early stages corresponding to each series of adults were also preserved. A small number of adult mosquitoes collected from houses, etc., was included. The writer wishes to record the valued co-operation of Mr. J. M. Hallpike, Chief Sanitary Inspector, and his staff, who collected a considerable number of the larvæ and recorded their breeding-places.

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* A "Preliminary Report on a Collection of Mosquitoes from Antigua, B.W.I.," based on this collection and embodying the essential data, has been submitted to the Government of Antigua for local publication, in 'The Leeward Islands Gazette.'

Dr. Edwards has worked out the collection at the British Museum, and his systematic notes appear as Part I. of this paper.

Since no ecological notes appear to have been published on mosquitoes in any of the Lesser Antilles, it may be of interest to record localities and notes on habitat as far as available. No claim is made that the list of Antigua mosquitoes is complete. The present work records the results of a part-time investigation carried out during a short period during the rainy season of 1938, but it may be assumed that the species most frequently to be encountered are here dealt with.

Anopheles (*Nyssorhynchus*) *albimanus* Wied.

Bettys Hope Garden, shady mud-pool in fringing forest (*Buceras bucida—Hippomane mancinella—Annona glabra* association), by Collins Stream, 2 Sept.*; Liberta Stream, 3 Sept. (with *A. tarsimaculatus* and *A. argyritarsis*); Burkes, sedge-swamp (*Fimbrystylis* spp.), 8 Sept.; Blubber Valley, pools, green with algæ, at edge of sluggish stream, 18 Sept. (with *A. argyritarsis*); Upper Cedar Hill, stream, 19 Sept.; Tuit (New Cotton), deep pools in a wide trench cut in almost pure limestone, 20 Sept.; John Hughes Stream, 23 Sept. (with *A. argyritarsis*); English Harbour, in old abandoned shallow well at edge of a Mangrove-swamp, 28 Sept. (with abundant larvæ of *Culex bahamensis*); Five Islands, in an old iron teche by the roadside, 8 Oct. (with *A. tarsimaculatus*); Weirs, in holes made by hooves of cattle in a muddy roadside trench in costal area, 13 Oct. (with *A. tarsimaculatus*, *Culex habilitator*, and *C. nigripalpus*); Carr's Gut, brackish pools in fringing forest (*Buceras—Hippomane—Annona* association), 18 Oct.

Anopheles (*Nyssorhynchus*) *tarsimaculatus* auctt.

Paynters, roadside trench at edge of canefields, 1 Sept.; Liberta Stream, 3 Sept. (with *A. albimanus* and *A. argyritarsis*); Gunthorpes, adult under mosquito-net in house, 18 Sept.; St. Mary's, saline pools in Mangrove-swamp (*Rhizophora mangle*), 18 Sept.; Parham Lodge, shady saline pool among *Hippomane* and *Annona* at back of mangroves (*Conocarpus erecta—Laguncularia racemosa*), 20 Sept.; Old Road, saline pools among Mangroves (*Avicennia nitida*), 28 Sept. (with *Aedes tæniorhynchus* var. *niger*); Old Road, adults in native houses, 6 Oct.; Five Islands, in old iron teches by the roadside, 8 Oct. (with *A. albimanus*); St. Clair, pools in a ravine (open woodlands), 9 Oct. (with *Culex atratus*); Freeman Bay, saline pools among mangroves (*Laguncularia*), 10 Oct.; Weirs, in holes made by hooves of cattle in a muddy roadside trench in coastal area, 13 Oct. (with *A. albimanus*, *Culex habilitator*, and *C. nigripalpus*).

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* Dates, unless stated otherwise, refer to those on which larvæ were collected.

There appears to be, a tendency for this species to prefer areas of saline water, generally near the coast, but it is to be observed that nowhere in such situations were the larvæ to be found in abundance; in most cases they were exceedingly hard to find.

Anopheles (*Nyssorhynchus*) *argyritarsis* R.-D.

Liberta Stream, 3 Sept. (with *A. albimanus* and *A. tarsimaculatus*); Old Road, in sluggish stream, 11 Sept.; Blubber Valley, pools, green with algæ, at edge of sluggish stream, 18 Sept. (with *A. albimanus*); John Hughes Stream, 23 Sept. (with *A. albimanus*); Hearten's, in sluggish stream, 25 Sept.

All of the localities where this species was found are in the district of relatively high rainfall, with mesophytic vegetation.

It may be worth recording that at no time were the larvæ of *Anopheles* spp. found in abundance, and rarely in numbers that would define their incidence as "frequent."

Psorophora (*Grabhamia*) *pygmæa* Theo.

English Harbour, roadside trench *, 10 Oct. (with *Aëdes tæniorhynchus* var. *niger*).

Aëdes (*Ochlerotatus*) *tæniorhynchus* Wied.
var. *niger* Giles.

English Harbour, roadside trench, 27 Sept.; Old Road, saline pools among Mangroves (*Avicennia*) 28 Sept.

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* The roadside trench at English Harbour is ecologically a part of the adjacent coastal mud-flats, which support an almost pure growth of "Salt Grass" (*Sporobolus virginicus*). A few hundred yards nearer the sea is a thicket of Black Mangrove (*Avicennia nitida*).

(with *Anopheles tarsimaculatus*); Old Road, in native houses, 6 Oct.; Freeman Bay, in crab-holes near mangroves, 10 Oct. (with *Culex habilitator*); English Harbour, roadside trench, 10 Oct. (with *Psorophora pygmæa*); Green Bay, pools in open coastal mud-flats (*Sesuvium portulacastrum*), 14 Oct.; Fort James and Corbizon Point, in crab-holes, 17 Oct.; Collins, in crab-holes in fringing forest (*Buceras—Hippomane—Annona* association) 17 Oct. (with *Deinocerites cancer*). Mr. Hallpike has sent the writer adults of this species collected in a house in St. John's in December. They are known locally as a "large black lazy mosquito," and are stated to be very quiet when biting, and not readily disturbed.

Essentially a coastal species.

Aëdes (*Stegomyia*) *ægypti* L.

St.-Johnston's Village, in house trenches, 12 Sept.; All Saints, swarming in a water-barrel in the village, 7 Oct.; Dry Hill, in hollow tree-trunk in a garden, 17 Oct.

Restricted to domestic and ruderal situations.

Culex (*Culex*) *bahamensis* Dyar & Knab.

English Harbour, in an old abandoned shallow well at edge of a Mangrove-swamp, 28 Sept. (with occasional *Anopheles albimanus*); Green Bay, in coastal swamps stated to be covered at high tides, 14 Oct.

A coastal species.

Culex (*Culex*) *habilitator* Dyar & Knab.

Freeman Bay, in crab-holes near mangroves, 12 Sept. and 10 Oct. (with *Aëdes tæniorhynchus* var. *niger*); Gaynors, one adult caught in a crab-hole, 11 Oct.; Weirs, in holes made by hooves of cattle in a muddy roadside trench in coastal area, 13 Oct. (with *Anopheles albimanus*, *A. tarsimaculatus*, and *Culex nigripalpus*); Green Bay, in crab-holes, 14 Oct. (with *Deinocerites cancer*).

Apparently the most widely distributed of the "wild" species of *Culex* in Antigua, with a marked preference for coastal situations.

Culex (*Culex*) *declarator* Dyar & Knab.

Wallings, larvæ in rock-pools in a forested ravine (*Inga laurina* forest), 4 Sept. (with *Culex elevator*).

Culex (*Culex*) *fatigans* Wied.

Gunthorpes, adults in house, 25 Aug.; The Folly, swarming in water-barrel, 4 Sept.; Wallings, adults collected on sides of concrete water-catchments, 4 Sept. (with *C. elevator*); Golden Grove, swarming in cesspools, 24 Sept.; St. John's, adults in house, 28 Sept.; Gunthorpes, adults in the laboratory, 5 Oct.; Otto Lane, swarming in a pool among houses, 18 Oct.

Like the other tropicopolitan mosquito *Aëdes ægypti*, this species is restricted to domestic and ruderal situations in Antigua.

Culex (*Culex*) *nigripalpus* Theo.

Weirs, in holes made by hooves of cattle in muddy roadside trench in coastal area, 13 Oct. (with *Anopheles albimanus*, *A. tarsimaculatus* and *Culex habilitator*).

Culex (*Micraëdes*) *americanus* N.-L.

Xerophytic bushlands E. of Willikies Village, in epiphytic Bromeliads (*Tillandsia utriculata*), 24 Sept.; Sugar-loaf Mountain, at 800 ft. altitude, adults in a hollow tree-trunk in forest approaching rain-forest type, 25 Sept. (Bromeliads abundant in vicinity); Sugar-loaf Mountain, in epiphytic Bromeliads (*Tillandsia utriculata* and *Wittmackia lingulata*) on summit ridge, at c. 900ft. alt., 25 Sept.; Bellevue, in epiphytic Bromeliads (*Tillandsia utriculata* and *Wittmackia lingulata*) in mesophytic woodlands, 12 Oct.; English Harbour, in epiphytic Bromeliads *Tillandsia*), on Manchineel Trees (*Hippomane*) and Wild Fig (*Ficus lævigata*), at edge of Mangrove-swamp, 28 Sept.

Appears to occur in " wild pines " throughout the island, irrespective of the type of country in which these are situated.

A character of the living larva is the bluish-violet colour of the thorax, only to be seen in certain lights, rather suggestive of the flourescence seen in quinine solutions.

Culex (*Melanoconion*) *elevator* Dyar & Knab.

Wallings, larvæ in rock-pools in a forested ravine (*Inga laurina* forest), 4 Sept. (with *C. declarator*).

A forest mosquito, like *C. declarator*.

Culex (Melanoconion) atratus Theo.

St. Clair, pools in a ravine (open woodlands), 9 Oct. (with *Anopheles tarsimaculatus*).

The larvæ of this species have a characteristic habit of hiding beneath floating leaves, debris, etc., and rest with the body almost parallel to the surface of the water, somewhat after the manner of *Anopheles*.

Deinocerites cancer Theo.

Millars, swarming in crab-holes among mangroves, 1 Sept.; Green Bay, in crab-holes, among mangroves, 14 Sept. (with *Culex habilitator*); Collins, in crab-holes in fringing forest (*Buceras—Hippomane—Annona* association), 17 Sept. (with *Aëdes tæniorhynchus* var. *niger*).

XXVII.—*Eine neue Fruchtfliege als Bambus-Schädling (Dipt.)*. Von E. M. Hering (Berlin).

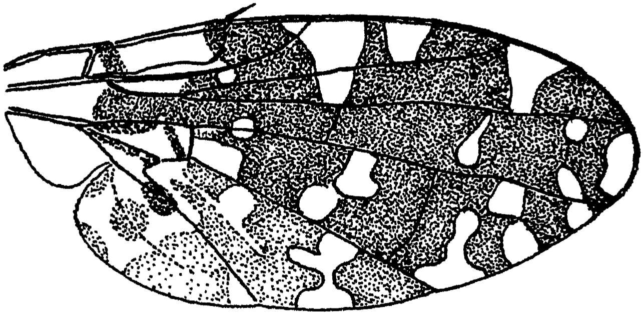
Vom Imperial Institute of Entomology, London, erhielt ich in einer Bestimmungssendung eine neue Art einer von mir unlängst beschriebenen Gattung (1939) übermittelt, die nachfolgend beschrieben werden soll.

Phæospilodes bambusæ, spec. nov.

Die Art steht sehr nahe der von Tonkin beschriebenen Gattungstype *Ph. torquata* Hering, so dass es genügt, auf die Unterschiede gegenüber der bereits beschriebenen Art (Verh. VII. Int. Kongr. Entomol. Berlin, 1938, vol. i. p. 171, f. 5) hinzuweisen. Die Palpen sind gelb und nur am Ende gebräunt. Der Thoraxrücken ist dunkelgrau gestriemt: vorhanden sind eine unpaare Mittelstrieme, je eine über die *dc* und die *prsut-sa*. Die Seitenstrieme im *sa*-Raume ist sehr schmal und verbreitet sich erst vor der Sutur. Die Mesopleure ist vorherrschend bleichgelb, von der unteren *mpl* geht eine nach vorn hin schnell verbreiterte dunkle Strieme zum vorderen Unterrande der Mesopleure. Rötlichgelb ist auch der Oberrand der Sternopleure. Schildchen zwischen den apicalen *sc* mit schwarzem Endfleckchen. Das Ovipositorbasalglied hat oben einen braunroten Mittelfleck und ist davor weiss behaart. Die Schenkel sind vorherrschend schwarz, nur die Knie schmal gelb, Hinterschenkel aber an der

Basis zu 1/3–1/4 gelb. Beim ♂ ist das 3. Tergit des Abdomens vorherrschend schwarz, das 5. mit schwarzem Hinterrand, der mit den beiden Flecken davor verbunden ist.

Im Flügel bestehen die wesentlichen Unterschiede darin (fig.), dass die *Cd* nur 2 Paare von Glastropfen enthält, das Glastropfenpaar der Cp_1 zwischen *ta* und *tp* fehlt, der Randfleck dieser Zelle ist beim ♀ sehr breit und erreicht fast die angrenzenden Adern, beim ♂ ist er rundlich. In der Verbindungslinie des *Csm*-Fleckes mit dem *tp* liegt ein hyaliner Schrägwisch anstelle des rundlichen Glastropfens. In der *Cm* liegen keine hyalinen Tropfen diesseits des *ta*, auch die Glastropfen der Cp_3 sind geringer an Zahl. In den übrigen Merkmalen stimmt die Art mit *Ph. torquata* Hering von Tonkin überein.



Flügel von *Phæospilodes bambusæ* Hering, ♀.

♂, ♀. Type von S. India, Coimbatore, 16. i. 1939, from bamboo shoots, A. G. R. Coll., im British Museum (Natural History), London.

XXVIII.—*The Affinities of the Palæozoic Pleuracanth Sharks.* By Sir Arthur Smith Woodward, F.R.S.

It has been evident for some time that the Permo-Carboniferous sharks of the family Pleuracanthidæ are at the end of a long lineage (7, p. 136). Their elongated shape, straight tapering tail, extended dorsal and caudal fins, and much modified anal and pectoral fins are marks of senile specialisation. Possible ancestors, however, have not hitherto been recognised among Devonian fishes and only a few isolated teeth resembling those named *Diplodus* have been found in the Upper Devonian of Illinois (8) and New York State, U.S.A. (9, p. 144).

The discovery of the Stegoselachii, or early Palæozoic shark-like fishes with a roof of bony plates on the head, seems at last to indicate the group among which the ancestors of the Pleuracanths should be sought. The roofing bones of the head of the Devonian Stegoselachii (1, 3) are so near the surface that they are ornamented with tubercles and are impressed with grooves for the sensory canals ; but in *Cratoselache*, the only Carboniferous genus which has hitherto been recognised (11), the bony plates have sunk deeper in the skin, are more or less degenerate, and bear no markings. The latter plates are very similar to those which have been ascribed to the Pleuracanths, and there can no longer be any doubt that these highly specialised sharks are the final representatives of the Stegoselachii.

The roofing plates of the skull have been so rarely seen and recognised in the Pleuracanths, that they may not have been present in all species. The median spine fixed at the back of the head seems to be the only constant remnant. The plates were first described as " membrane bones " by E. D. Cope (5) in a skull of *Didymodus* from the Permian of Texas, U.S.A. ; they were vaguely noticed by C. Brongniart (4, p. 4) in one specimen of *Pleuracanthus gaudryi*, where he recorded them as " des sortes d'écailles de forme indéterminée en plaques brillantes et lisses, analogues aux écailles des Ganoides " ; and a fine example of the greater part of the roof of *Pleuracanthus* from the Coal Measures of Northumberland was afterwards described by J. W. Davis (6, p. 718, pl. lxvii. fig. 2). The descriptions by Cope and Davis, however, are very unsatisfactory, and that by Davis is marred by his failure to distinguish broken bits of cartilage from the plates. In his restored outline sketch of the roof Davis is also mistaken in interpreting two hollows in the crushed fossil as the orbits.

The roofing bones of the skull so far as they are preserved in the only known specimen of *Cratoselache* have already been recognised as being arranged on the same plan as those of the Arthrodiran *Dinichthys*. Those in the unique specimen of *Pleuracanthus*, which are more numerous and better preserved, are also arranged as in

Dinichthys. Using the nomenclature of Traquair, the median and external occipital plates are seen behind; the elongate-triangular central plates follow next in front; the hexagonal pineal plate then separates these from the preorbitals; and among the displaced lateral plates the large marginals can be identified behind. The median occipital bears at its hinder border the articulation for the dorsal spine, which is seen again in an isolated plate from the same formation and locality (6, pl. lxviii. fig. 8). The dorsal spine is thus clearly shown to be not fixed to the cranium, but to a roofing plate.

This spine is not cleft at the base behind, and bears no mark of a connected fin. The structures which Brongniart (4) regarded as supports of a fin seem to be merely some branchial rays. The spine may indeed be compared with that which is fixed in a cleft in the median dorsal plate of the Rhynchodontid (10, 12) and Acanthaspid (2) Arthrodira. It has only become displaced forwards.

If the Pleuracanths are Stegoselachii, the absence of ordinary Elasmobranch shagreen is explained. The varied character of the pectoral fins in this group is also further indicated. In the Lower Devonian *Pseudopetalichthys* (3) and *Gemuendina* (1) they are tribasal and closely similar to the pectorals of modern sharks and rays respectively. In the Lower Carboniferous *Cratoselache* they consist of stout parallel bars. In the Pleuracanths they are always unibasal and "archipterygial."

From these various considerations I suggest that the Ichthyotomi, comprising the Pleuracanths, should be regarded as the last and most highly specialised suborder of the Stegoselachii.

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XXIX.—*A new Subspecies of Red Deer from the Upper Pleistocene of Jersey, Channel Islands.* By FREDERICK E. ZEUNER, Ph.D., F.Z.S., British Museum (Natural History), and London University Institute of Archæology.

A BEACH-CONGLOMERATE found at about 25 foot above middle water in the cave of the Belle Hougue, north coast of Jersey, Channel Islands, has puzzled palæontologists for more than twenty years. Geological evidence bears out that the 25-foot beach around the island was formed during the last interglacial, but the fauna enclosed in the deposit mentioned seemed to indicate a late Pliocene age. This impression was chiefly caused by the presence of a small form of deer which Andrews (1919, Bull. Soc. Jers. xxiv. p. 108) compared with *Cervus etueriarum* and *C. issiodorensis* from the so-called late Pliocene of the Auvergne, though he expressly did not identify the Jersey form with any kind of deer known to him. Later on, his words were too readily interpreted as a definite determination, and the "late Pliocene 25-foot beach" was widely accepted.

A re-examination of the bones, however, has shown that they belong to a minute race of red deer, curious in several respects, and that there is no reason whatever for assigning the 25-foot beach to any other phase but the last interglacial (Riss-Würm). A full description of the fauna of the cave and its implications will appear in this year's 'Bulletin de la Société Jersiaise.'

The most conspicuous parts preserved of the deer are the antlers. The holotype has a pedicle 2 cm. high. The brow-tine is inserted 4 cm. above the burr. The bez-tine is absent, and the beam measures 17 cm. between brow- and trez-tine. Tines and beam lie nearly in one plane. The absence of the bez-tine is striking, but none of the antlers can have belonged to fallow-deer. In this species, the brow-tine sits on the burr and forms a very wide angle with the beam, and the latter is strongly bent outwards. There is, however, much resemblance to *Sika* in most of the essential characters. A comparison of the fossils with specimens of *Sika* in the British Museum (Natural History) proved that the fossil form is within the range of variation of this Recent east Asiatic genus, at least as far as the antlers are concerned. The holotype of *Sika hortulorum* (61.6.2.1.) approaches the fossil very closely, having a high pedicle, high insertion of brow-tine, and a similar bend of the beam. It is more slender generally, but other specimens of *Sika* exhibit thicker beams, so that this difference would not have to be taken seriously.

The only feature of the antler, which deviates to some extent from *Sika*, is the angle between brow-tine and beam. In the average of 15 specimens of *Sika* it is 70°, the largest measured angle being 80°. In the fossil form, the average of four measurable specimens is 85°, with the smallest value 75°, the largest 95°. This angle thus appears to be somewhat too large for *Sika*.

The genus *Sika* is allied to the genus *Cervus* proper, *i. e.* the group of *C. elaphus*, the red deer, in which the angle averages 95° (smallest value 85° *). In its typical form *C. elaphus*, however, has a bez-tine, absent both in *Sika* and the fossil, and the size is much larger than that of *Sika*. The red deer of north America (the Wapiti) and of east Asia attain the size of a horse, but going west one observes a gradual reduction in size until, in central Europe, north France and Great Britain one meets geographical subspecies of moderate size, as they are familiar to everybody. The most westerly subspecies of red deer are the Barbary deer and the Corsican deer. They are the smallest of all living red deer. This decrease in size westwards suggests that the fossils from the Belle Hougue cave might belong to a minute insular race of

* Eight specimens measured, all of which had no bez-tine.

western red deer, and not to *Sika* which, for geographical reasons alone, is unlikely to have occurred in Europe.

This suggestion can be substantiated in two different ways:—

(1) The antlers of red deer from western Norway (*C. elaphus atlanticus* Lönnberg), Spain (*C. e. hispanicus* Hilzheimer), and (owing to interbreeding to a minor degree) those from Great Britain very often have no bez-tine, and in Barbary and Corsican deer it is quite normally absent. The absence of this tine in the deer from the Belle Hougue thus appears to be a character common to all western subspecies of red deer.

(2) A feature of the shoulder-blade finally settles the question of the specific relationship of the fossil form. Shoulder-blades of deer show on the inner side close to the hind margin a ridge which is steep and pronounced in red deer, weaker in *Sika* and weakest in fallow deer. In addition, this ridge is very close to the edge in red deer, and removed from it in fallow deer. In this character, the deer from the Belle Hougue plainly agrees with *Cervus elaphus*.

Thus, there is no justification in considering the deer from the 25-foot beach of Jersey as anything but a race of *Cervus elaphus*, its small size being connected with the island habitat. It appears to have evolved from the western branch of *Cervus elaphus* during the last interglacial, when Jersey was for a long period completely severed from the Continent. Supplementary evidence for its being a dwarf race is provided by the metacarpus which, proportionately, is much shorter than in ordinary red deer, and almost reminiscent of goat. Since all other geographical races of red deer have received subspecific names, the fossil form from the Belle Hougue may be distinguished as *Cervus elaphus jerseyensis*, ssp. n.

Cervus elaphus jerseyensis, subsp. n.

Diagnosis.—A race of red deer with short legs and antlers reminiscent of those of *Sika*, with high pedicles and without a bez-tine, of roe or fallow deer size.

Holotype and paratypes in the Museum of the Société Jersiaise at St. Hélier, Jersey, Channel Islands.

Type-locality and formation.—Belle Hougue cave, north coast of Jersey. In the conglomerate of the 25-foot beach. Interglacial Riss-Würm.

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XXX.—*Some Notes on the Dugong.* By R. I. POCOCK, F.R.S. (Zoological Department, British Museum).

THIS paper is the outcome of an examination of the skeletons, mainly of the skulls, of the Dugongs preserved in the British Museum and in the museum of the Royal College of Surgeons, which brought to light some apparently unrecorded facts of interest and extended our knowledge of a few features previously imperfectly dealt with. My cordial thanks are due to Dr. A. J. E. Cave for giving me the fullest possible access to the specimens under his charge in the College of Surgeons, and to his assistant, Mr. Thompson, for his help in a variety of ways.

The Distribution and principal Scientific Names of the Dugong.

The distribution of Dugongs is extensive. They have been recorded from Madagascar and other islands of the Indian Ocean, and on the east coast of Africa at various points northwards from as far south as Delagoa Bay (Barrett, Journ. Mamm. xvi. p. 219, 1935), and from the Red Sea. Whether they are, or were, found on the coasts of eastern Arabia, of Persia, Baluchistan, and north-western India I am not aware; but they are known from the coasts of Malabar and western Ceylon and in the Bay of Bengal from the Andamans, Mergui, and the Nicobar Islands, and thence south-eastwards to the Philippines, at least as far north as Formosa (Hirasaki, Proc. 5th Pacif. Sci. Congr. 1933, p. 4221), and from the northern coast of Australia, where, according to Le Souef (' Wild Animals of Australia,' p. 103, 1926), the range is from Moreton Bay in the east to Broome, 18° S. lat., in the north-west *.

The distribution is sufficiently wide to give scope for differentiation into distinguishable forms. The typical form, *Dugong dugon* P. L. S. Müller, 1776, has been traditionally fixed as " Indian." But Ehrenberg (Symb. Phys. Mamm. dec. ii. 1833) gave the name *Halicore hemprichii* to a specimen from Barkan Island in the northern part of the Red Sea, and in a footnote on the same page the name *lottum* to a specimen from farther south, differing from the first in certain dental peculiarities suggesting that it was merely a younger animal. A year later Rüppell (Mus. Senckenb. p. 99, 1834) tentatively described the Red Sea Dugong as *Halicore tabernaculi*, on the chance of it proving distinct from the Indian Dugong. From the scanty material of skulls from the western Indian Ocean and the Red Sea I am unable to substantiate the validity of the Red Sea form ; but Krauss (Arch. Anat. Phys. 1870, p. 605) mentioned some features in which his Red Sea specimens apparently differed from a few East Indian skulls he had. I mistrust their value, but do not feel justified in adding *hemprichii* definitely to the synonymy of *dugon*. It may prove to be racially distinct.

Owen (Jukes' " Voyage of the 'Fly,' " 2, Appendix, p. 323, 1847) separated the Australian Dugong from the Indian and Red Sea Dugongs under the name *Halicore australis*, the type-locality being Endeavour Strait, Cape York. He evidently had very little material to work with, and, judging from the considerable number of Australian skulls I have seen, I agree with Gray (Cat. Seals and Whales, p. 361, 1866) that the Australian and Indian forms are systematically identical. Gray's conclusion was subsequently and independently reached by Annandale (Journ. As. Soc. Beng. (n. s.) i. p. 238, 1905) *.

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* There is, however, a skeleton in the British Museum from Sharks Bay, about 25° S. lat. on the west coast (F. M. Rayner, " Voyage of the 'Herald,' " no. 62.2.8.4). But the bones appear to be weathered as if from exposure on the beach, and possibly belonged to a carcase washed ashore from farther north. An earlier record, however, is from the Swan River.

The Fusion of Cranial Sutures.

A peculiarity of the skulls of both *Trichechus* and *Dugong* is the late closing of most of the sutures. In *Dugong* the interparietal suture closes early to form a solid plate to react to the pull of the powerful masticatory temporal muscles. The median frontal suture, at least in its posterior part, fuses a little later. The next to disappear, but much later, is the basioccipital suture, which remains open until long after the last cheek-teeth are considerably worn. In quite large skulls the occipital bone, with its condyles, is frequently missing owing to slipping away as a solid block when the skull is cleaned. Later the exoccipitals fuse with the supraoccipital. In the fore part of the skull the lacrymal bone long remains loose and movable ; and in old skulls the median rostral suture becomes nearly obliterated. In the table of measurements (p. 342) skulls with the basioccipital suture fused are considered to be adult, large skulls with it still open are young adults. Other indications of age are supplied by the number of cheek-teeth, by the extent of wear of the last, and by the size and weight of the skull, which is very heavy in adults of both sexes.

The Tusks of the Male.

In male skulls even before the closure of the basioccipital suture the tusks project from 2 to 3 inches beyond the alveoli, one of them being sometimes longer than the other. In this sex they are said to grow throughout life from persistent pulps, a statement, in my opinion, open to question. The main part of the shaft is approximately the same diameter throughout its length ; but the protruding portion, which is coated with enamel from a short distance below the edge of the alveolus to the tip, is narrowed towards the point and noticeably bevelled on its outer side, so that the extreme end, when unbroken, forms a compressed, blunt edge. They vary individually in diameter, sometimes to a considerable extent.

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* It is very regrettable that Annandale's final report was withdrawn because of the publication of the paper by Dexler and Freund on the Australian Dugong (Amer. Nat. xl. pp. 49 & 567, 1906, and Archiv. Naturg. i. p. 77, 1906).

It is commonly supposed that the tusks are used solely as weapons in the combats between rival males, and scars on the skin have been assigned to wounds inflicted by them; but they frequently show evidence of wear, sometimes indeed of being broken, such as could hardly result from impact against comparatively soft integument. The signs of attrition or fracture may indeed have been caused by the striking of tusk against tusk during a fight, but they are more suggestive of scraping or knocking against hard substances like rocks; and it is possible the tusks are used for tearing sea-grasses or sea-weeds * from the sea-bottom to which they are attached. This suggestion is borne out by the attrition of the extruded tips of the tusks in some females, which presumably do not use the tusks for fighting.

A ♂ skull † from Mafia Island, off the coast of Tanganyika (B. W. Savory, no. 32.11.4.2), is not fully adult, as indicated by the absence of the occipital bone, which has slipped from the skull. Only two molar teeth, however, remain on each side of the jaws, the last being double and worn, measuring 24 × 14 mm., and the tusks are long and comparatively massive as shown in fig. 1 A. The left is a little longer than the right and projects over 60 mm. beyond the alveolus in front, its basal length at the alveolus being 30 mm. and its width 26 mm. They are only slightly worn at the tip.

A skull from Lamu, on the coast of Kenya (J. Haggard, no. 85.4.20.2), has, like the skull from Mafia Island, lost its occipital bone, but is a little smaller and manifestly younger, as shown by the cheek-teeth, of which the last three are *in situ* but the last is not fully erupted, having a conical point measuring 11 × 13 mm. The tusks are much smaller, projecting only 42 mm. beyond the alveolus in front, with the basal length and width 20 mm., but the points are manifestly much more worn. Their total length from the open pulp-cavity, some distance below the summit of the rostrum, to the tip is about 145 mm.

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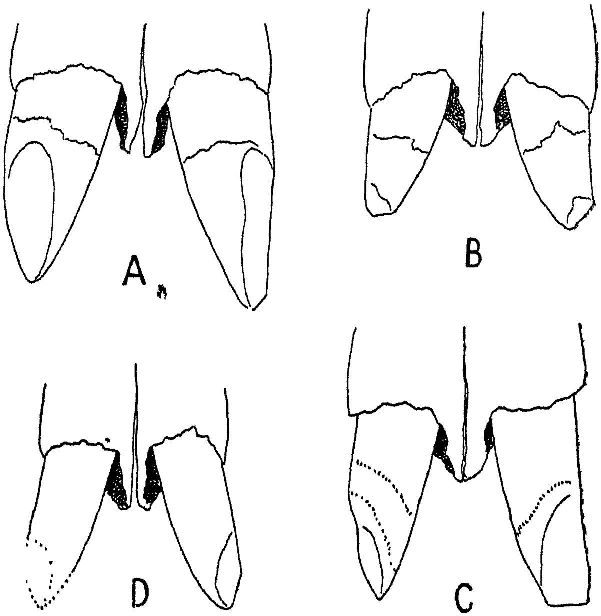
* Although sea-weeds (algæ) have been found in their stomachs, most observers agree that Dugongs prefer marine phanerogams, the so-called sea-grasses (*Zostera*, *Poseidonia*), a diet more nearly resembling that of their terrestrial ancestors.

† This skull and that of the ♀ with the same history, recorded below, were figured and described by Dollman (Nat. Hist. Mag. iv. p. 117, 1933).

In a young adult ♂ skull, which, although merely labelled "Indian Ocean," probably came from part of the coasts of the Bay of Bengal or of Ceylon, since it was received from the Indian Museum (no. 79.11.21.174), the tusks are very similar to those of the specimen from Mafia Island.

Fig. 1.



Showing variation in the size and wear of the tusks of some males in the British Museum.

A. Front view of the tusks of a young adult ♂ Dugong from Mafia Island, Tanganyika Territory (Savory, no. 32.11.4.2).
B. The same of a younger ♂ from Lamu, Kenya (Haggard, no. 35.4.20.2).
C. The same of a young adult from Moreton Bay, E. Australia (Grundy, no. 1027 *i*).
D. The same of a young ♂ from Darnley Island, Torres Strait (Earl of Derby, no. 46.8.26.4). The tip of the right tusk, artificially broken, is dotted in.

A young adult skull, with all the sutures open, from Moreton Bay, E. Queensland (H. D. Grundy, no. 1027 *i*), has the tusks intermediate in size between those of the skulls from Mafia Island and Lamu. The right tusk is shorter than the left and has the tip more pronouncedly bevelled, suggesting greater use. The left projects about 52 mm. beyond the alveolus, where its basal length is 26 mm. and its width 22 mm. The last two cheek-teeth are *in situ* and worn, the last being 22 mm. long and 14 mm. wide in front, very nearly the same as in the skull from Mafia Island.

A young ♂ skull from Darnley Island, Torres Strait (Earl of Derby, no. 46.8.26.4), in which the loss of the occipital bone attests the openness of the basioccipital suture, has noticeably thin tusks. The right is artificially fractured at the tip, but the left projects 47 mm. beyond the edge of the alveolus, where the basal length is 20 mm. and the width 15 mm., a good deal less than in the skull from Lamu. The extracted tusk is 131 mm. long, 30 mm. less than the height of the rostrum, and its pulp-cavity is about 45 mm. deep. The point is bevelled but shows no definite evidence of wear. This skull seems to be approximately the same age as the one from Lamu, judging from the presence of three functional cheek-teeth and the small size of the last, but the tusks, which are the same diameter throughout except at the point, are narrower, longer, and much less worn. The rostrum also is correspondingly narrower.

The largest ♂ tusks examined are in a fully adult skull, from Australia, in the Royal College of Surgeons (no. 2698). The basioccipital suture is fused and the last two cheek-teeth on each side are in use, the last being 23 mm. long and 14 mm. wide in front, about the same size as in the skull from Mafia Island. The tusks, however, are larger; they project 70 mm. beyond the alveolus, where they have a length of 30 mm. and a width of 22 mm., the width being a trifle less than in the skull from Mafia Island. These tusks project 23 mm., nearly 1 inch, more beyond the alveolus than those from Darnley Island, and have a much greater diameter. This difference suggests that the ♂ tusks in Dugongs vary in size in a manner comparable to the variation in elephants.

The Tusks of the Female.

There has been a good deal of misconception about the tusks in the female. Quoting Rüppell, Owen, in 1847, stated that "in old males and even in females of the Dugong of the Red Sea the upper incisive tusks project two inches from the gum. In this respect the Red Sea Dugong deviates still further than does the Indian species from the Dugong of the Australian coasts." This statement is a little ambiguous. The words "in this respect" can only apply to the projection of the teeth beyond the gum in the female, and the expression "two inches" was meant no doubt to apply only to the male. The statement, nevertheless, that the tusks in old females project beyond the gum was ignored by later English authors. Huxley, for instance, in 1871 (Anat. Vert. p. 332), wrote "the tusks in the female remain concealed in their alveoli." Twenty years later Flower and Lydekker ('Mammalia,' p. 220) wrote :—"In the female they remain through life in the alveolar cavity, they are not exserted, and the pulp-cavity being filled with osteodentine they soon cease to grow." Blanford used the same dubious phrase, "not exserted in the female." It is not clear whether exserted refers to the alveolus in the skull or to the gum in the living animal. Lydekker, however (Harmsworth's Nat. Hist. ii. p. 825, 1910), was more precise, saying, "In the female the incisors are small and do not pierce the gum." Even as recently as 1928 Weber (Die Säugeth. ii. p. 495) repeated Huxley's statement about the tusks being in the alveolus. It appears, indeed, to be the common belief that in the female the tusks are invisible in the living animal, whereas in the male they can be seen in the front of the mouth, so that the two sexes can be readily distinguished.

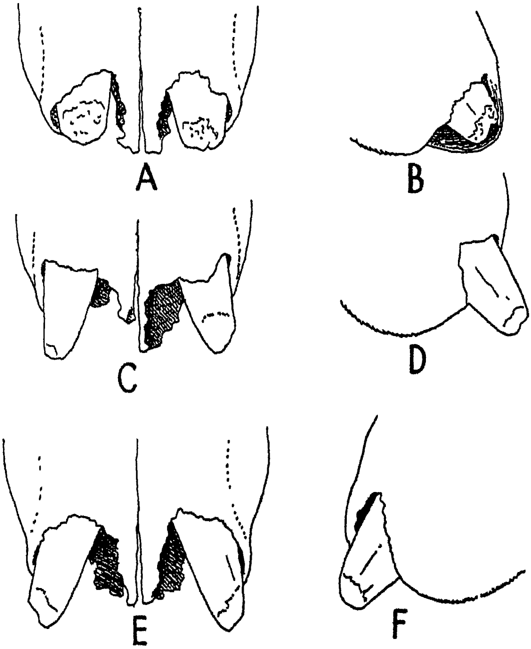
The truth about the tusks of the female appears to be as follows :—In young specimens they are lodged in the lower or distal portion of the rostrum. The conical, cement-coated, roughish point is sunk below the edge of the alveolus ; the pulp-cavity is open and deep and the alveolus is closed a little above it. The growth of the tusk is mainly upwards and the alveolus gradually deepens to accommodate it, ultimately reaching the summit of the rostrum, with the proximal end of the tusk just below it. It is not until the base of the tusk has reached this position that the pulp-cavity closes and growth ceases. But before this event the tip of the tusk descends at all events to the level of the median and lateral edges of the alveolus, and is plainly visible in front although still cement-coated and apparently beneath the gum. But in several female skulls there seems to be no doubt that the tusks were through the gum. At all events, the points project considerably beyond the alveolus, are to a varying extent shiny and enamelled, and show what appear to be unmistakable evidence of being worn by use.

It is not, however, at all clear what use the tusks may be to the female at any stage of their growth. The points, when through the gum, may be accidentally worn against rocks or the sea-floor when the animal is browsing; but why the upper or proximal portion of the tusk should continue to develop until its growth is stopped by the filling of the pulp-cavity at the summit of the rostrum is not obvious, unless its use is to add weight to this portion of the head to facilitate feeding at the bottom of the sea.

The skull of an adult ♀, labelled "Australia," purchased from Strange (no. 1027 *a*; 52.6.26.1), with the basi-occipital suture obliterated but the exoccipital sutures still open, has the tips of the tusks visible both from the side and front views, but they are roughened, irregularly rounded, coated with cement, without trace of enamel, and were clearly beneath the gum in the living animal. That they would never have been exposed is attested by the closure of the pulp-cavity, which is visible just beneath the summit of the rostrum where the closed end of the alveolus is exposed by the breaking or absorption of the bone. The entire tusk is 174 mm. long, only a little less than the height of the rostrum. This skull may be taken as illustrating the normal tusks in adult ♀ Dugongs (fig. 2 A, B). The tips of the tusks are, however, sometimes protruded considerably beyond the orifice of the alveolus in ♀ Australian skulls. In one collected by J. B. Jukes (no. 1027 *c*; 46.7.17.19), which probably came from Port Endeavour, the locality of Owen's type of *D. australis*, the left tusk projects about

22 mm. beyond the alveolus in front, its point shows signs of wear and was apparently through the gum. The closure of the pulp-cavity shows that the growth

Fig. 2.



Showing variation in the protrusion and wear of the tusks of some female Dugongs in the British Museum.

A. Front view of the tusks of an old ♀ from "Australia" (purchased from Strange, no. 52.6.26.1), showing the usual condition in adults of this sex, the tips not piercing the gum in life.
B. Lateral view of the right tusk of the same.
C. Front view of the tusks of an adult ♀ from Mafia Island, Tanganyika Territory (Storey, no. 32.11.4.3), the points apparently through the gum and differently worn on the two sides.
D. Lateral view of right tusk of the same.
E. Front view of the tusks of an adult ♀ from the Strait of Manaar (Sir W. Elliot, no. 42.11.11.7), showing approximately the same extent of apparent protrusion through the gum as in C.
F. Lateral view of left tusk of the same.

of the tusk had ceased. Its entire length is 197 mm., a trifle longer than the height of the rostrum, and 23 mm., nearly 1 inch, longer than the tusk of 1027 *a*. The right tusk is a little shorter and had apparently not cut the gum.

In a young adult ♀ from Collier Bay, N.W. Australia (Wembley Exhib., no. 39.1.28.1), about 50 mm. shorter in its condylo-basal length than 1027 *a*; the tips of the tusks, as in that skull, are rough and unworn and not below the level of the sides and middle of the alveolar orifice. They were clearly not through the gum, but their total length of 124 mm., about 44 mm. less than the height of the rostrum, and the unfilled pulp-cavity, showing that growth had not ceased, suggests that the tip might have been exposed in the living animal if it had reached maturity.

An earlier stage in the growth of the tusk is shown in a ♀ skull from Hammond Isl., Torres Strait (H.M.S. 'Alert,' no. 82.1.26.10), which, although only about 8 mm. shorter in condylo-basal length than the skull from Collier Bay, is obviously considerably younger. The tips of the tusks are buried about 10 mm. within the alveolar orifice. The total length of the tusk is only about 82 mm., about half the height of the rostrum, and the pulp-cavity is open and deep.

Of two ♀ skulls in the Royal College of Surgeons, from Sumatra (Raffles, nos. 2688, 2689), the latter, which is subadult, with the basioccipital suture open but only two cheek-teeth left, the last measuring 25 mm. long and 16 mm. wide in front, the tusks project as much as 37 mm. from the alveolus in front, and having a polished, bevelled point were clearly well through the gum. They are 194 mm. long, and, although extending to the summit of the rostrum, still have a definite hollow representing the remains of the pulp-cavity.

A fully adult, heavy ♀ skull from the Straits of Manaar, between Ceylon and South India (Sir W. Elliot, no. 42.11.11.7), with the basioccipital and exoccipital sutures closed, has protruding tusks very similar to those of the Sumatran skull above described, but with the exposed enamelled point a trifle shorter, 32 mm. beyond the alveolus in front. The total length of the tusk, however, is greater, 212 mm., and its base, exposed at the summit of the rostrum, has no hollow indicating the pulp-cavity. The last molar is much worn, is 27 mm. long and 17 mm. wide in front (fig. 2 E, F).

On account, apparently, of the projection of the tusks below the alveoli this skull was identified by Elliot as that of a ♂, and this determination was endorsed by Thomas, who marked the skull with that sign. But I have no doubt it is a ♀ skull, since the exposed portion of the tusk is very much shorter and narrower, having a basal length of 13 mm. and a width of 12 mm., than in the ♂ skull from the Indian Ocean above referred to, which has tusks very similar to those of the ♂ from Mafia Island. The Manaar skull, nevertheless, is considerably older than either of these.

The ♀ skull from Mafia Island (B. W. Savory, no. 32.11.4.3) is older than that of the ♂ referred to above, having the basioccipital suture closed but the exoccipital suture open. The last three cheek-teeth are in use, the last upper being much more worn and therefore considerably larger than in the ♂, measuring 29 × 17 mm. The tusk has attained its greatest length. Its base has nearly reached the summit of the rostrum and its pulp-cavity is only about 15 mm. deep; its total length of 197 mm. slightly exceeds the height of the rostrum. Its tip projects well beyond the edge of the alveolus, 22 mm. in front and 11 mm. behind, its basal length being 16 mm. and its width 14. There is no doubt that it was through the gum, since its point shows unmistakable evidence of wear, the cement in places being rubbed off and exposing the enamel (fig. 2 C, D).

Age-variations in the Cheek-teeth.

Three of the ♀ Australian skulls above discussed may be cited as illustrations of the changes that take place in the number and size of the cheek-teeth in Dugongs as age advances. In the youngest from Hammond Island there are four cheek-teeth on each side, but the last has a simple, unworn, tubercular, conical summit, which was clearly not through the gum. The older skull from Collier Bay has three cheek-teeth in use on each side, the last being bicylindrical and worn, with a total length of 21 mm. and an anterior width of 12 mm. In the oldest skull (1027 *a*) there are two functional cheek-teeth, the last being bicylindirical and worn as in the skull from Collier Bay, but it is considerably larger, 29 mm. long and 15 mm. wide in front.

From these and similar data observed in other skulls it is evident that the cheek-teeth diminish in number with age and that the last increases in size as it is pushed up and worn.

The function of the cheek-teeth is not quite clear. Their growth from persistent pulps and their flattened or hollowed crowns, when above the gum, show that they are subjected to considerable wear. But the stomach of a ♂ Australian Dugong, examined by Annandale, contained pieces of marine plants, which appeared to have been swallowed without mastication, even the bladders of the seaweeds being uncrushed. His suggested explanation of the worn condition of the molars was that it was caused by the attrition of calcareous or sandy particles taken into the mouth but sifted from the digestible vegetable food by means of the rough, horny plates covering the front of the jaws in the Dugong. Those plates seem more suited for getting a grip on slippery weeds, and it appears more probable that the wear of the teeth is due to the grinding of the tough fibres of large pieces, mixed no doubt sometimes with hard inorganic substances.

Measurements in English Inches of some Skulls.

Since no adult skulls from the Red Sea are available it may be pointed out in connection with the following table of measurements that Krauss (Arch. Anat. Phys. 1870, p. 563) published many detailed dimensions of skulls from that extension of the Indian Ocean. The total lengths of his longest ♂ and ♀, measured from the occipital crest, were the same, namely 390 mm. (=15½ in. as nearly as may be), and his shortest of the same sexes 348 and 352 mm. (=14 in. approximately), showing no difference in size between the ♂ and ♀. Since that dimension is very nearly the same as the condylo-basal length, it seems that skulls from the Red Sea are about the same size as those found elsewhere. Some dimensions given by De Beaux (Ann. Mus. Genov. lv. p. 215, 1931) point to the same conclusion. The basal length of two specimens from Fatmah and Assab were 340 and 320 mm. respectively. The same dimension in four ♀ skulls in the British Museum from Mafia Isl., Moreton Bay (1027 *f*), Laheiya, and Collier Bay are 357, 341, 322, and 312 mm. respectively.

In the following table of measurements skulls are considered to be adult when the basioccipital suture is fused, although the line of fusion may be still visible. When the basioccipital suture is open they are regarded as young adults or young, the difference between these two ages being judged by the cheek-teeth and other features.

The skulls in the Museum of the Royal College of Surgeons are marked "R.C.S.," with their catalogue number. Those not so marked are in the British Museum.

Most of the dimensions entered need no explanation, but it may be added that the height of the rostrum is taken from its rounded summit to its lowest edge, and that the height of the symphysis of the mandible is similarly taken from the summit of the downbent portion of the ramus.

The measurements show, amongst other things, that there is no foundation for Owen's claim that Australian skulls are shorter than Indian skulls but have a longer rostrum and downbent portion of the mandible.

Although adult ♂ and ♀ skulls from Australia completely overlap in size the measurements suggest average superiority in the ♂. The data from other districts of the Indian Ocean are insufficient to warrant conclusions on this point. It may be noted that the ♀ skulls from Mafia Island and the Manaar Strait are a little larger than any of the measured Australian skulls of that sex, and that the ♂ from Mafia Island, when fully grown, would have been about the size of the largest ♂ Australian skulls; also that the lower end of the rostrum, measured above the tusks in front, is on the average wider in the ♂ than in the ♀, in accordance with the sexual difference in the size of the tusks.

The Scapula of the Dugong and of the Manatee.

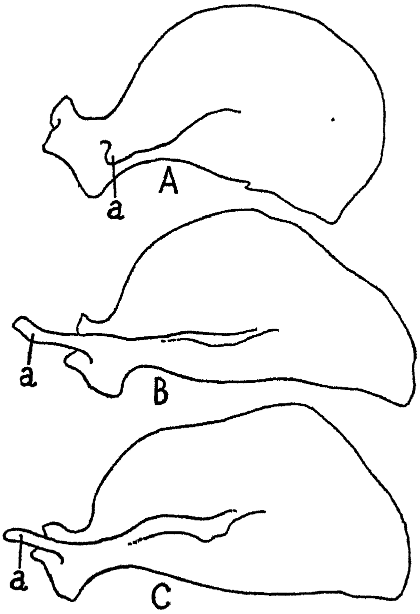
The scapula of recent Sirenians calls for passing notice, partly on account of the inexplicable reticence of the writers of text-books about this bone and partly because of the contradictory evidence supplied by some skeletons in the British Museum regarding the truth of Owen's statement (Anat. Vert. ii. p. 436, 1866) that it differs

Locality and sex.	Cond.-basal length.	Zygomatic width.	Across post-orbital processes.	Height of rostrum.	Upper width of rostrum.	Lower width of rostrum above tusks.	Height of mandible at coronoid.	Height of mandible at symphysis.
East coast of Africa and Red Sea.								
Mafia Isl. (Savory, 32.11.4.2); yg. ad. ♂	15·9	8·5	6·3	7·9	3·6	2·7	6·6	5·2
Mafia Isl. (Savory, 32.11.4.3); just ad. ♀	15·8	9	6·2	8	4·2	2·1	7·1	5·5
Lamu (Haggard, 35.4.20.2); yg. ♂	15·3	8·1	6·3	7	3·5	2·6	6·5	5
Red Sea (McFadyen); yg. ♂	15·4	8·1	6·3	7·4	3·4	—	—	—
Laheiya, Red Sea (McFadyen); yg. ♀	14	7·7	5·8	6·7	3·1	1·9	6·3	4·9
Red Sea (Krauss, 70.8.16.1); yg. ♀	13·2	7·9	5·5	6·6	2·9	1·6	6·2	4·7
India, Malaya, Sumatra.								
Indian Ocean (Ind. Mus. 79.11.21.179); yg. ad. ♂	14·4	8·2	6	7·6	3·8	2·7	7·1	4·8
Manaar Strait (Elliot, 42.11.11.7); ad. ♀	15·4	8·6	6·7	8—	4·2	2·3	7·2+	5·9
Indo-Malaya (R.C.S. 2694); ad. ♂	14·9	8·5	6·4	7·7	3·6	3·2	7·2	5
Sumatra (Raffles, R.C.S. 2690); yg. ♂	13·8	7·9	6·3	7·1	3·1	2·7	7·2	5
Sumatra (Raffles, R.C.S. 2689); yg. ad. ♀	14·7	8·4	6·3	7·5	3·6	1·8	6·6	5·2
Sumatra (Raffles, R.C.S. 2688); yg. ad. ♀	14·3	7·9	5·9	7·1	4·3	1·8	6·4	5·1
Australia (arranged by sex).								
Australia (R.C.S. 2695); ad. ♂	16·2	8·7	6·4	8·2	3·6	2·8	7·6	6
Moreton Bay (Harris, 1027 *h*); ad. ♂	16·1	8·6	6·6	8	3·5	3·3	7·3	5·7
Moreton Bay (Grundy, 1027 *i*); yg. ad. ♂	16·1	8·9	6·5	7·2	3·2	2·6	—	—
Repulse Bay, E. Queensland (85.2.21.1); ad. ♂	15·4	9·4	6	7·9	3·3	2·8	7·2	5·5+
E. coast of Queensland (33.3.2.1); ad. ♂	14·3	8·7	6·4	7·3	3·3	3	6·8+	5·6
N.E. Australia (Jukes, 1027); ad. ♂	13·9	8·4	6·4	6·9	3	2·1	—	—
Darnley Island (Derby, 46.8.26.4); yg. ad. ♂	(13·6)	7·5	6·8	6·6	2·8	2	—	—
Australia (Strange, 1027 *a*); ad. ♀	14·8	8·5	6·4	7·6	3·3	2·2	6·8	5·8+
Moreton Bay ('Rattlesnake,' 1027 *f*); yg. ad. ♀	14·6	8·4	6·4	6·8	3·3	1·7	6·9	5
Moreton Bay ('Rattlesnake,' 1027 *g*); yg. ♀	13·2	6·9	5·5	6·4	2·7	1·8	5·5	4·2
E. coast of Queensland (33.3.2.2); ad. ♀	14·8	8·5	6·4	7·6	3·2	2·2	6·8	5·3
Queensland (R.C.S. 2699); ad. ♀	14·5	8·7	6·7	7·5	3·5	1·9	6·2	5·6
Collier Bay, N.W. Australia (39.1.28.1); yg. ad. ♀	13·5	8·1	5·9	6·8	2·8	1·6	6·2	5·1

in structure in the Dugong and Manatee, the acromion being short in the former and long in the latter.

Although the two types of scapulæ differ to a certain extent individually with age, the differences between them are well marked. In both kinds the bony ridge or crest, very inappropriately called the "spine," rises near the centre of the blade and runs downwards towards the glenoid articulation for the humerus; but in one case its free edge is inclined outwards and slightly backwards, and ends in a short, angular acromion near the narrowest

Fig. 3.



Rough, unmeasured sketches of the scapulæ of Dugongs and Manatees.

A. Scapula of a young male Dugong from Lamu, Kenya, with the suprascapular epiphysis missing, showing the shape of the crest or " spine " and of the acromion (*a*) in the genus *Dugong*.
B. Scapula of an adult male Manatee from the Gaboon belonging to the skeleton assigned to the skull of a male Dugong from Repulse Bay, E. Queensland.
C. Scapula of a female Manatee from Surinam (no. 370 *e*), to show the crest and produced acromion (*a*) characteristic of the genus *Trichechus* (*Manatus*).

part, or "neck," of the bone; in the other its free edge turns slightly forwards, is continued beyond the neck of the bone, and is produced into a long rod-like acromion which projects considerably beyond the coracoid and the anterior edge of the glenoid, lying outside the notch which separates these two prominences. Moreover, in the former type, with the short acromion, the antero-superior border of the scapula is more strongly convex, the posterior border more strongly concave, especially behind the crest, and there is a small but distinct marginal spike at about the level of the upper end of the crest.

There is very little doubt that Owen was right in assigning these different types of scapulæ to the Dugong and Manatee respectively, but I was for some time baffled by finding in the British Museum scapulæ of both kinds associated with skulls and skeletons of the two genera, suggesting that the bone might be dimorphic, the differences being possibly sexual, in accordance with the use of the flipper in the female for nursing her young; and when the evidence on this head was contradictory it seemed that it might be explained away by errors in the determination of the sex of the specimens by collectors.

The facts are as follows:—Out of a comparatively large number of articulated and disarticulated skeletons examined three identified as Dugongs have scapulæ with a long acromion and two of the Manatees have scapulæ with a short acromion, a large majority in the case of both genera agreeing with Owen's verdict on the point. One of the so-called Dugong's skeletons is imperfect, has no skull or history, and may be dismissed as wrongly identified generically. Another of the Dugongs, represented by a complete disarticulated skeleton, and labelled "Repulse Bay, Australia (no. 85.2.21.1)," was purchased from Gerrard, the dealer, in 1885. In the same year the Museum purchased from the same dealer the complete disarticulated skeleton of a Manatee from the Gaboon (no. 85.6.30.1). By counting and fitting together the cervical vertebræ of the skeleton labelled "Repulse Bay," Dr. Fraser and I were able definitely to establish the truth of my surmise that the skeletons of the two animals had been confused, the skull of the

Dugong from Repulse Bay being assigned to the skeleton of the Manatee from the Gaboon and *vice versa*. This accounts for two of the Dugongs and one of the Manatees.

The other assumed errors are not so easily explained away. The remaining Dugong, with a long acromion, is a mounted skeleton from the Red Sea (no. 70.8.16.1), one of Krauss's specimens, purchased through Gerrard. Since there is evidence that Krauss had Manatees as well as Dugongs, it is possible that he was unacquainted with the difference between their scapulæ, and sent Gerrard the flippers of a Manatee with the rest of the bones of the skeleton of the Red Sea Dugong. The second Manatee, with a short acromion, is also an articulated skeleton, labelled "*Manatus australis* (no. 370 *f*)."

I can make no suggestion to account for this assumed mistake, but I feel assured that the explanation of it and of that connected with the Red Sea Dugong are similar to the explanation of the confusion, about which there is no doubt, between the Dugong from Repulse Bay and the Manatee from the Gaboon.

The interest of the point here discussed lies in the possibility of similar mistakes having been made in other museums. The skeletons in the Museum of the Royal College of Surgeons agree in their scapulæ with Owen's diagnosis, and Flower must have been well acquainted with them; but in 1891, when he published with Lydekker his volume on Mammalia, he must presumably have been equally well acquainted with the skeletons above referred to in the British Museum. Possibly his inability to reconcile the discrepancies may be the reason for his omission to mention the marked difference in this bone in the two existing genera of Sirenia. Max Weber, and others who copied Flower to a great extent, are similarly reticent.

XXXI.—*Land Planarians from the Palau and Caroline Islands, Micronesia.* By LIBBIE H. HYMAN, American Museum of Natural History, New York City.

A COLLECTION of land planarians made in the Palau and Caroline Islands, Micronesia, by Y. Kondo, in the spring of 1936, was turned over to me for identification by the Bernice Bishop Museum, Honolulu, Hawaii, to which institution the labelled material and slides have been returned for permanent deposit. For convenience the collector's numbers in the vials are used below in referring to the specimens.

The land planarians of the Palau Islands were already collected by Semper, whose specimens are described and named by von Graff in his classical monograph (1899) of this group. With all due admiration for the herculean labours of von Graff on the Turbellaria, it cannot be denied that many of the descriptions and figures of land planarians in his monograph are unsatisfactory from the point of view of future recognition of the species. Unfortunately, the Palau Islands species, of which nine are described as new by von Graff, are among those treated in a very cursory and inadequate manner. For this reason, it has been very difficult for me to decide whether my species coincide with those found by Semper. Von Graff gives only the external characters, and places great reliance upon the colour-pattern, which, however, is certainly highly variable in at least some species of land planarians. An example of such variation is given below in connection with *Rhynchodemus atropurpureus*. Further, the colours are often altered through preservation, as the following incident will illustrate. A specimen of *Bipalium kewense*, received from Hawaii, was stated by the collector to have been grey with purple stripes in life; but when the specimen reached me only a short time after collection it was already yellowish brown with blackish-brown stripes. Von Graff fortunately was able to present notes made by Semper on the colours in life of the Palau Islands planarians; but there is no way of knowing how these colours are affected by preservation, and I am forced to compare the colours of preserved specimens with von Graff's descriptions of the colours in life. Despite these difficulties, I have thought it best wherever at all possible to allocate my specimens to .the species already known from Palau rather than to create new species of doubtful validity. This seems the only course possible at present in view of our lack of knowledge of the variability of the coloration of land planarians with respect to age, locality, and preservation.

The majority of the specimens are referable to *Dolicho-*

plana striata Moseley, 1877, which thus must be considered the most common land planarian of the Palau and Caroline Islands. *Geoplana pelewensis* and *Rhynchodemus atropurpureus* also appear to be relatively abundant.

Family **Geoplanidæ.**

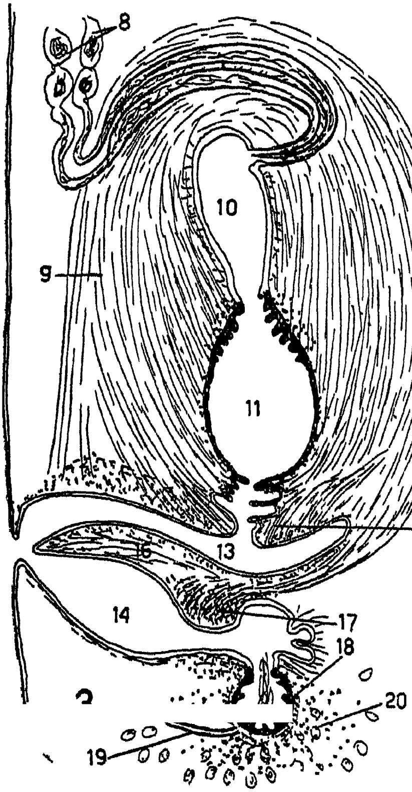
Geoplana pelewensis von Graff, 1899. (Figs. 1–3.)

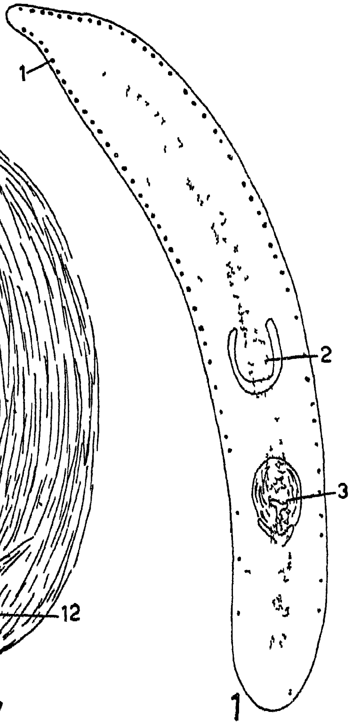
Locality.—Three specimens, no. 145 from Jokaj Islet, Ponape, Caroline Islands, no. 175*a* from Angaur, Palau Islands, and no. 234 from Olov, Yap Island ; all localities practically at sea-level. Von Graff's specimens collected by Semper at Peleliu, Palau Islands. The species is apparently widely spread among the islands of Micronesia.

External characters.—Von Graff (1899) gives a large coloured figure (pl. iv. fig. 4) ; describes the ground-colour as light brown with a touch of violet, but the figure appears greyish brown. My specimens light to medium brown, with a conspicuous mid-dorsal dark stripe (fig. 1) and a faint lateral stripe on each side. Stripes begin some distance behind anterior end, as also noted by von Graff. Form short, somewhat plump, about 10 mm. in length, with a narrowed anterior end from which the body quickly widens, about retaining this width to the rounded posterior extremity. Von Graff's figure, drawn from life in extended condition, naturally more slender and tapering than mine, which are undoubtedly somewhat contracted. However, *G. pelewensis* is evidently a small, short, somewhat plump species. Single row of eyes along each side, beginning slightly behind anterior tip ; first eye in each row small ; next eyes larger with a few smaller ones intermixed ; behind middle of the body eyes small and farther apart. Relative positions of pharynx and copulatory apparatus shown in fig. 1.

Transverse section.—Section oval (fig. 2), with creeping sole occupying the greater part of the ventral surface. No ciliated grooves found in anterior part of the body, nor was "Drüsenkante" (longitudinal band of gland-cells on the ventral surface near the margin) in evidence.

Sexual anatomy.—All three specimens sexually mature ; no. 175 *a* mounted entire ; posterior halves of nos. 145 and 234 sectioned for study of the copulatory apparatus. Ovaries ventral in usual anterior position. Testes





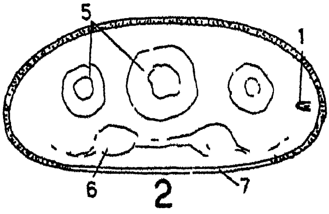


Fig. 1.—*Geoplana pelewensis.*
Fig. 2.—Transverse section of *G. pelewensis.*
Fig. 3.—Sagittal view of the copulatory apparatus of *G. pelewensis.*

For all figures: 1, eyes; 2, pharynx; 3, penis; 4, genital pore; 5, digestive branches; 6, nervous system; 7, creeping sole; 8, vasa deferentia; 9, penis-bulb; 10, non-glandular chamber of the seminal vesicle; 11, glandular chamber of seminal vesicle; 12, penis papilla; 13, male atrium; 14, female atrium; 15, common genital atrium; 16, fold; 17, sphincter; 18, glandular duct; 19, oviduct; 20, cement-glands; 21, mouth; 22, ejaculatory duct; 23, glandular canal of penis; 24, vagina; 25, penis-sheath; 26, valve. Glandular epithelium black.

moderately numerous, situated ventrally below and slightly between the intestinal diverticula, beginning at the level of the ovaries and extending to copulatory apparatus. Copulatory apparatus (fig. 3) with several peculiarities. No common genital atrium, but male and female atria separated almost to the genital pore by a fold or partition. Male apparatus consists of large oval very muscular penis bulb and shallow penis papilla, probably somewhat compressed by contraction of animal on death. Vasa deferentia on reaching anterior end of penis-bulb turn dorsally, course through muscular coat of penis-bulb, and then curve ventrally, uniting to a very short common duct which at once opens into seminal vesicle. Seminal vesicle (cavity of penis-bulb) divisible into an anterior non-glandular and posterior larger glandular chamber. Lining epithelium of glandular chamber filled with secretion granules from adjacent gland-cells. Broad shallow penis papilla quite muscular, composed partly of circular fibres and partly of continuations of longitudinal fibres of penis-bulb. Narrow canal-like male atrium leads ventrally to the genital pore.

Female atrium also canal-like, somewhat wider than male atrium, proceeds vertically, terminating dorsally in blind sac with folded dorsal wall. Von Graff labels such folds "uterus," but there appears no justification for this usage. Glandular duct, a rounded sac lined by a highly glandular epithelium, extends posteriorly from dorsal part of female atrium. It has a somewhat muscular wall, is encircled by gland-cells, and receives the oviducts into its ventral wall. Sperm present in cavity of glandular duct. A strong sphincter of circular fibres, thicker on side next the male atrium, guards entrance from female atrium into glandular duct.

Remarks.—In the general anatomy of the copulatory apparatus, *G. pelewensis* greatly resembles *G. assimilis* from the Philippines (von Graff, fig. 40, p. 190) and is undoubtedly closely related to this species and two others (*G. canaliculata*, Philippines, and *G. korotneffi*, Sunda Islands), stated by von Graff to resemble *G. assimilis* in their sexual anatomy. The outstanding feature of this group of species is the fold separating the male and female atria.

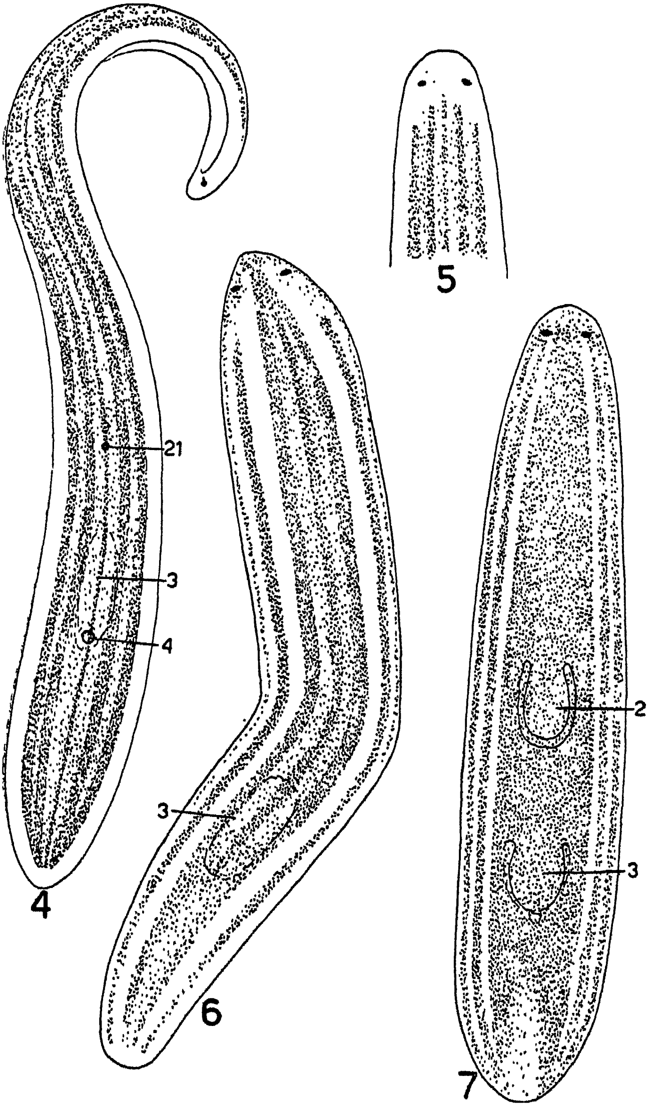
Family **Rhynchodemidæ.**

Rynchodemus atropurpureus (von Graff), 1899, new comb. (Figs. 4–9.)

Syn. *Platydemus atropurpureus* von Graff.

Locality.—Three specimens, no. 159 from Koror, Palau Islands, no. 175 *b* from Angaur, Palau Islands, and no. 184 *a* from Peleliu, Palau Islands. Semper's specimen also came from Peleliu. The species appears to be limited to the Palau group of islands.

External characters.—The colour-pattern of the three specimens differs considerably, but study of the copulatory apparatus proved that all three are conspecific. Only no. 159 (fig. 4) agrees satisfactorily with von Graff's coloured figure (1899, pl. xvi. fig. 7). No. 159 has broad brownish-black longitudinal band and reddish-brown margin. Five indistinct longitudinal stripes present in the band, median stripe narrower than the others. Von Graff's figure shows all five stripes of equal width, but text states central stripe narrower than the others. Head of no. 159 shown in fig. 5, where stripes are seen to stop back of the eyes, as also noted by von Graff. Ventrally no. 159 has broad dark band of same width as dorsal band with dark margins, forming a more or less definite stripe. No. 184 *a* (fig. 6) has mid-dorsal band, in which three stripes are distinguishable; to each side of band is a dark stripe, and there is a faint darkening along the margin. General ground-colour yellowish brown ; ventral surface somewhat pigmented, especially near margins. No. 175 *b* (fig. 7) had mid-dorsal brownish-black longitudinal band similar to 184 *b*, but without stripes ; to either side of band are two narrow dark stripes on a yellowish-brown ground ; ventral surface uniformly yellowish brown. In both 175 *b* and 184 *a*, the median band continues forward to meet pigment along anterior margin ; but this effect may result from considerable contraction of the specimens. On comparing the colour-patterns of the three specimens, one concludes that the fundamental colour-pattern of the species consists of a broad dark dorsal band on a lighter ground. Band may include five stripes, as in fig. 4, or only three stripes, leaving the outermost stripes free, as in figs. 6 and 7 ; an additional pair of marginal stripes may be present, as in fig. 7, also faintly indicated in fig. 6.

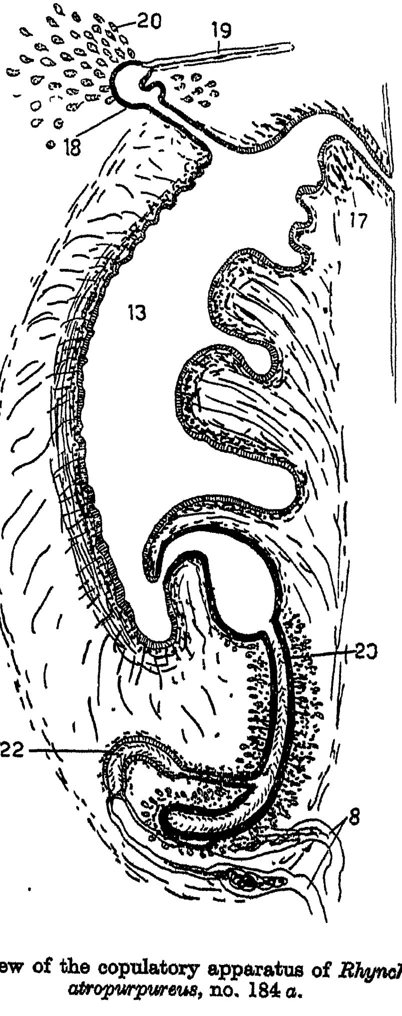


Rhynchodemus atropurpureus.

Fig. 4.—No. 159, having one broad dorsal band containing five stripes.
Fig. 5.—Anterior end of no. 159.
Fig. 6.—No. 184 *a*, having a mid-dorsal band containing three stripes, and separate lateral stripes.
Fig. 7.—No. 175 *b*, having two lateral stripes on each side and a mid-dorsal band of uniform pigmentation.

Shape in life probably best represented by fig. 4; narrowed anterior end with pair of eyes and blunt head

Fig. 8.

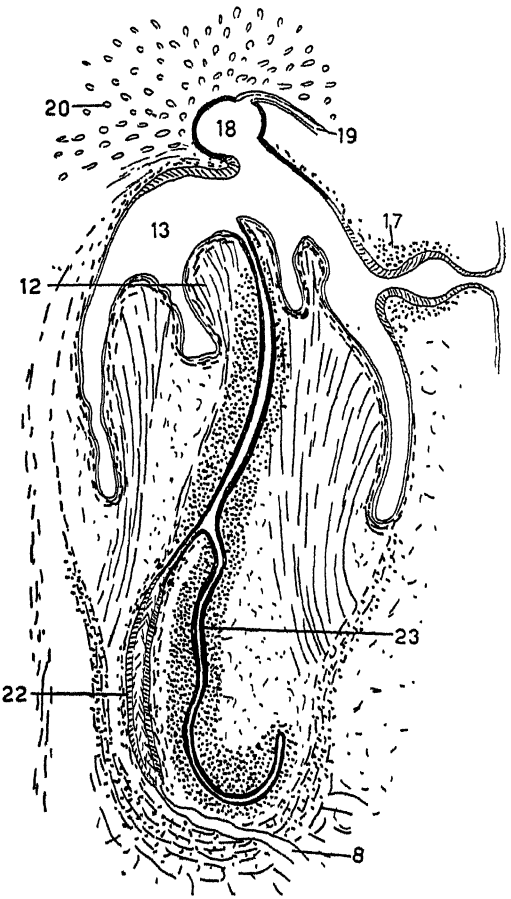


Sagittal view of the copulatory apparatus of *Rhynchodemus atropurpureus*, no. 184 *a*.

gradually widens to a somewhat broad flat posterior end. Length 8–13 mm.; Semper's specimen, on which von Graff based his description, was 17 mm. long.

Transverse section.—Of elongated form. Von Graff placed this species in the genus *Platydemus*, but according to Heinzel's analysis (1929) of the Rhynchodemidæ,

Fig. 9.



Sagittal view of the copulatory apparatus of *Rhynchodemus atropurpureus*, no. 175 *b*.

Platydemus belongs to those Rhynchodemids in which the longitudinal muscle-fibres of the body-wall are arranged in definite bundles. Transverse section shows no such bundles in *R. atropurpureus*, and hence the species is transferred to *Rhynchodemus*.

Sexual anatomy.—All three specimens sexually mature; anterior halves mounted whole, posterior halves sectioned. Copulatory apparatus identical in nos. 159 and 184 *a*; no. 175 *b* differs somewhat, but the differences appear to be functional rather than morphological. Sagittal view of copulatory apparatus of nos. 159 and 184 *a* in fig. 8. Large oval male organ, separated from parenchyma by muscle stratum. No definite penis papilla, but lumen of male organ large, with greatly folded walls ventrally and laterally, less folded dorsally. Lining epithelium of male atrium underlain by a thick muscle-layer of inner circular and outer longitudinal fibres. Vasa deferentia penetrate anterior end of male organ, course dorsally in the muscle-coat, and enter separately the ciliated canal-like ejaculatory duct. This curves ventrally, narrows to a tube, which opens into middle of a long curved blind glandular canal, having thick coat of circular muscle-fibres and lined by glandular epithelium receiving the secretion of numerous gland-cells. This glandular canal of the penis begins blindly near vasa deferentia, curves dorsally, then runs backward to open through one of the folds of the penis lumen. In no. 184 *a* (fig. 8), glandular canal expands in its course through the fold, but has no such expansion in no. 159 (not illustrated). In all three specimens ventral lobe of fold is narrower than dorsal. Comparison of figs. 8 and 9 show that fold represents a retracted penis papilla.

Female apparatus very simple, consisting only of glandular duct extending posteriorly from posterior wall of genital atrium. Its distal end expands into a chamber receiving oviducts into its ventral wall. Entire glandular duct surrounded by eosinophilous gland-cells opening through its lining epithelium. Common genital atrium below glandular duct narrows to canal leading to genital pore; place of narrowing guarded by a sphincter of circular muscles.

Copulatory apparatus of no. 175 *b* in sagittal view in fig. 9. This at first appears quite different from fig. 8, but closer inspection shows difference consists in protrusion of penis-folds to form a penis papilla. Penis papilla consists of three lobes, lateral flanking lobes, and central larger lobe bearing the termination of the glandular canal. Presumably fig. 8 represents penis at rest and fig. 9 gives the erected condition.

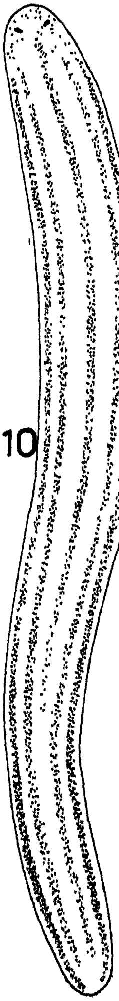
Remarks.—Without study of the copulatory apparatus it would have been impossible to know that these three specimens are conspecific. In older works, where great reliance was placed on colour-pattern, they would undoubtedly have been considered distinct species. One suspects that many of the alleged species of land planarians are merely colour variations. The course of the ejaculatory duct inside the penis is peculiar; as shown in figs. 8 and 9, the duct does not proceed directly to the penis tip, as is usual in planarians, but opens by a stalk into the middle of a long blind canal of glandular nature. The wall of this canal is extremely muscular, and there can be little doubt that the secretion is expressed by muscular contraction during copulation. The only other species showing a similar condition, to my knowledge, is *Rhynchodemus gravelyi* de Beauchamp, 1930, from India, in which the glandular canal of the penis is quite separate from the ejaculatory duct, both opening independently on the penis papilla. The fortunate finding of the male apparatus in different functional states may prove of value in interpreting the male complex in the genus *Rhynchodemus.* It is known that many species of this genus apparently lack a penis papilla, having a male apparatus similar to that shown in fig. 8. Other species possess a well-differentiated projecting penis papilla. Figs. 8 and 9 show, however, that the folds of a male atrium which seems to be devoid of a penis papilla can be erected to form a well-defined papilla, and this undoubtedly happens when the penis is in use. The gap between the species without and those with a definite penis papilla is thus bridged. On the other hand, no transitions appear to exist between the *Rhynchodemus* species with and those without a seminal bursa. In view of the large number of species assigned to *Rhynchodemus*, it may eventually be necessary to subdivide the species among two genera retaining those lacking a bursa in the genus *Rhynchodemus.*

Platydemus lividus von Graff, 1899. (Figs. 10–11.)

Locality.—Three pieces, assumed to be one animal, assigned with some hesitation to this species, collected

Yap, Caroline Islands. Von Graff's specimen found by Semper on the island of Peleliu, Palau group.

10



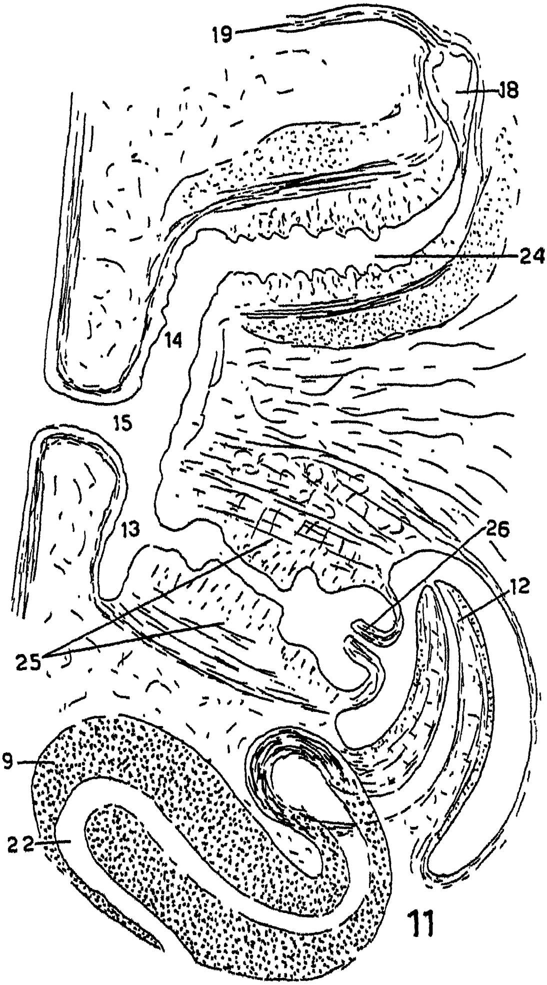


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Fig. 10.—*Platydemus lividus.*
Fig. 11.—Sagittal view of the copulatory apparatus of *P. lividus.*

External characters.—View of animal restored from pieces in fig. 10; may be compared with von Graff's coloured figure, pl. xv. fig. 3. Colour light greyish violet with five dark stripes according to von Graff; my specimen yellowish brown with five dark stripes. Distance between median and lateral stripes about twice as great as between lateral and marginal stripes, as also case with von Graff's specimens. The median stripe is absent from the two rear pieces of my specimen, hence must disappear posterior to pharynx. Marginal stripes darker and more sharply defined, but not narrower than others. Stripes begin some distance behind eyes, as also in von Graff's specimen. Form slender, elongated, with but slight narrowing to bluntly rounded extremities; 12 mm. long, on assumption that nothing is missing; von Graff's animal 20 mm. long.

Sexual anatomy.—One of the pieces contained the entire copulatory apprratus and was sectioned sagitally; the other pieces mounted whole. Copulatory apparatus has similarities to the figures of von Graff of the sexual complex of species of *Platydemus* (1899, pp. 204–205), and to those of de Beauchamp (1929). Sagittal view in fig. 11. Vasa deferentia penetrate anterior surface of a thick-walled dorso-ventrally elongated structure, presumably corresponding to the penis-bulb of other forms, but much more separate from the penis papilla than is usually the case with a penis-bulb. Bulb has heavy coat of circular muscle-fibres and pursues sinuous course to the base of the penis papilla. Its lumen, the ejaculatory duct, turns first ventrally, then dorslly, and after following bend of penis-bulb, enters base of penis papilla and continues to its tip. Penis papilla small, weak, cylindrical, inclosed in cavity, part of male atrium, connecting with common genital atrium by passage, having very thick, moderately muscular walls. This structure is termed sheath by von Graff. A valve guards opening from cavity containing penis papilla into lumen of penis-sheath. Wall of sheath consists of loose network of circular and longitudinal muscle-fibres. Female part of copulatory complex similar to male part in that thick-walled passage, "vagina" of von Graff, intervenes between common gential atrium and glandular duct; this has thick coats of longitudinal and circular fibres. It narrows distally to rounded chamber, the glandular duct, receiving the oviducts from below. Whether oviducts unite or not before entering glandular duct not determinable because of imperfections in the set of sections.

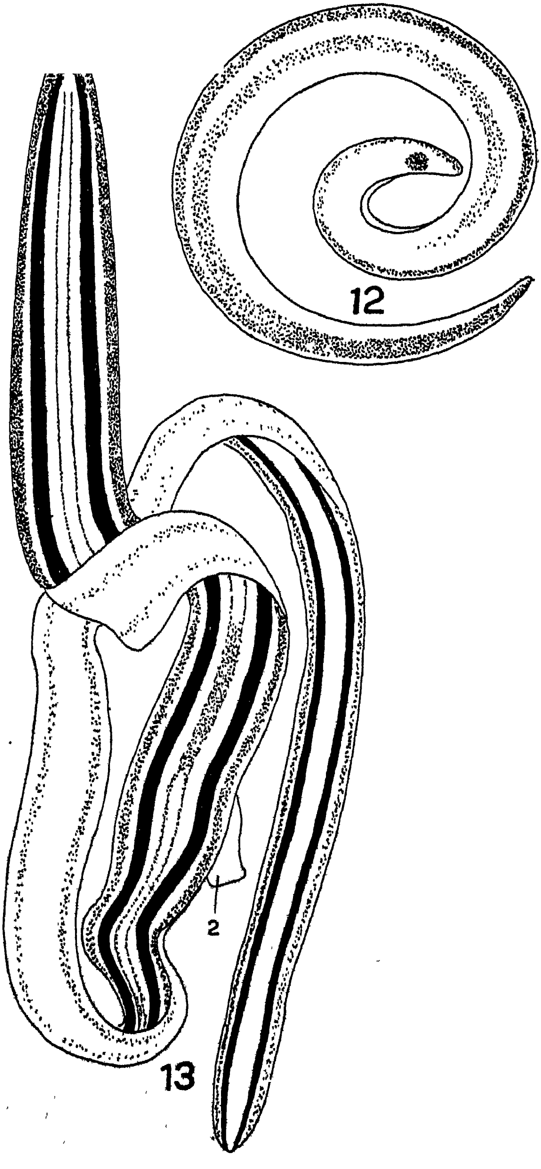

Fig. 12.—Unidentified Rhynchodemid.
Fig. 13.—*Dolichoplana striata*, no. 263.

Remarks.—My retention of this species in the genus *Platydemus* is based wholly on the resemblance of the copulatory apparatus to that of other species of *Platydemus*, notably *P. fasciatus* (Spencer) 1892. In his revision of the Rhynchodemidæ, Heinzel (1929) has employed chiefly histological characters in distinguishing the genera. Without transverse sections it is difficult, if not impossible, to apply Heinzel's generic distinctions. Having no transverse sections of *P. lividus* available, I have been forced to rely on the anatomy of the sexual complex. Heinzel includes *P. fasciatus* in his list of true *Platydemus* species, and because of resemblances between *fascitus* and *lividus*, I am retaining the latter in *Platydemus*. *P. lividus* differs from other species of *Platydemus*, of which the copulatory apparatus is known, in the separation of the cavity containing the penis papilla from the rest of the male atrium and the presence of a penis-like valve between the two cavities.

Dolichoplana striata Moseley, 1877. (Fig. 13.)

As already mentioned, I am referring the majority of the specimens in the collection to this species. I must hasten to add that in so doing I am in accord with the opinion of de Beauchamp (1929) that *D. striata*, *procera*, *feildeni*, and probably *picta* are all one and the same species. According to von Graff (1899), *D. procera* differs from *D. striata* only in lacking the two narrow mid-dorsal stripes. Although these stripes are not mentioned in Moseley's original description of *D. striata*, they are evident on his figure of the transverse section, so that they must be considered typical of the species. *D. feildeni* differs from *striata* in that the marginal and lateral stripes are equally dark and distinct, and *picta* varies from *striata* only in some details of head pigmentation. The copulatory complex is known only for *D. feildeni*, and the status of these speces can never be determined with certainty until this complex is known for each of them; unfortunately, *Dolichoplanas* are very seldom taken in the sexual state, and none of my specimens are sexual. A thorough study of the variability of the colour-pattern of living *D. striata*, with respect to age and locality, is also needed for a solution of the problem.

External characters.—Some specimens in the collection are very typical of von Graff's definition of *D. striata,* and one of these, no. 263, fig. 13, a fine perfect specimen, may be described as standard for the species. Length 120 mm., mouth about 50 mm. from anterior end. General ground-colour yellowish brown, with six longitudinal dark stripes, paired median, lateral, and marginal. Two median stripes very narrow, evident anteriorly, fading away shortly behind the pharynx, hence absent posteriorly. Lateral stripe on each side very conspicuous, black, sharply defined, beginning at the level of the eyes, continuing as well-marked bands to the posterior tip. Marginal stripes less dark, diffuse, ill-defined, of about same width as lateral stripes, continuous anteriorly with the pigmentation of the anterior tip, fading away posteriorly. Creeping sole white, occupying about one-third the width of the ventral surface, bordered on each side by diffuse pigmentation; rest of ventral surface yellowish brown.

Locality notes and coloration of other specimens in the collection.—It seems desirable to describe briefly the other specimens referred to *D. striata,* using the collector's numbers.

No. 133.—Collected Ponape, Caroline Islands. One juvenile *D. striata,* about 30 mm. long, broken into two pieces, shows the two narrow median stripes in region of pharynx only. Also two very young worms, about 7–8 mm. long, without any median stripes, lateral stripes closer together medially, and creeping sole wider than in adult *D. striata.* Vial also contains an indeterminable fragment of a land planarian, apparently not *D. striata.*

No. 139.—Collected on Mt. Tamatamansakir, Ponape, Caroline Islands, elevation 800–900 feet. Several pieces, probably originally one large specimen, no median stripes, hence corresponding to *D. procera.*

No 141.—Collected on Not Peninsula, Ponape, Caroline Islands. One complete juvenile specimen, 40 mm. long, without median stripes, hence corresponding to *D. procera.*

No. 184 *b*.—Collected at Peleliu, Palau Islands. Three pieces without the median lines, hence also like *D. procera.* No 184 *b*, found in this vial, was considered above.

No. 250, vial 1.—Collected at Yap, Caroline Islands, on a hillside back of Colony Town. Three pieces of moderate size, also lacking median stripes, hence like *D. procera*.

No. 250, vial 2.—Collected same locality. One large fine specimen of *D. striata*, 170 mm. long, mouth 40 mm. from anterior end. Ground-colour greenish brown; marginal and lateral stripes typical; median lines visible under magnification on prepharyngeal region, absent behind pharynx. Postpharyngeal piece removed and sectioned in hope of finding copulatory apparatus, but none was present.

No. 263 —Collected at Yap, Government House Yard, described above.

Remarks.—From these observations it seems probable that the two median lines are limited to the larger specimens and are absent in juvenile *D. striata*. The above records extend the distribution of undoubted specimens of *D. striata*, originally found in the Philippines, to the Palau and Caroline islands. *D. procera* originally came from the Palau Islands. and has since been recorded from the Kei Islands by Schroder (1918) and from Java by de Beauchamp (1929) and myself (unpublished identification of a specimen sent by the U.S. National Museum). If *D. striata* and *D. procera* are identical, as seems probable, then *D. striata* is widely spread throughout the islands of the Pacific. If they are not identical, then both occur in the Palau and Caroline Islands.

Unidentified Rhynchodemid. (Fig. 12.)

One single specimen, no. 148, collected at Jokaj Islet, Ponape, Caroline Islands, at 805 feet elevation, appears to differ from other forms of the collection and is not referable to any of the species known from the region. Without making transverse sections, it is impossible to allocate it to a genus, and as the animal appeared to by young, without any sexual system, the work of sectioning it did not seem worth while. The worm was therefore mounted whole, and is illustrated in fig. 12. Length, 10 mm., colour yellowish brown with four dark longitudinal stripes on the dorsal surface; median stripes darker and more definite than lateral stripes. Lateral stripes begin some distance behind the anterior end as vague pigment bands, grow wider and more distinct posteriorly, being finally joined by the median stripes some distance prior to the posterior tip. Most distinguishing feature, an area of black pigment around each eye.

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XXXII.—*Contributions on the Palæontology of Afghanistan.—Oligocene* (?) *Mollusca.* By L. R. Cox, M.A., Sc.D., Department of Geology, British Museum (Natural History).

[Plate VII.]

INTRODUCTION.

THE fossils now described form a small part of a collection obtained by Professor H. G. Schenck, of Stanford University (California), and several colleagues on a geological reconnaissance of parts of Afghanistan made in 1938 on behalf of the Inland Exploration Company. I am greatly indebted to Professor Schenck for the privilege of studying this interesting collection, and to the Company mentioned for permission to publish the results. The fossils described have been presented to the Department of Geology of the British Museum (Natural History).

Except for an early paper by a Captain Hay (1840), which includes crude figures of a number of undetermined fossil shells, some possibly of Eocene age, and a recent note by Dr. B. Prashad (1937) describing some Upper Tertiary non-marine shells, the only previous paper describing Tertiary mollusca from Afghanistan is a recent contribution by myself (1938) dealing with material from northern Afghanistan collected by MM. H. de

Cizancourt and H. Vautrin. The shells there described, which are of Lower and Middle Eocene age and belong almost entirely to the family Ostreidæ, are of interest as indicating the extension into Afghanistan of deposits of the same peculiar facies as those which have long been known to exist in Turkestan, where their fossil contents have been investgated by a number of workers, mainly of Russian nationality *.

Collections from the same series of Eocene deposits in Afghanistan were also made by Professor Schenck and his colleague Mr. G. L. Postle. The fossils obtained by them belong mainly to the species of *Ostrea* described in my previous paper.

The present note is devoted to the description of a small series of rather poorly preserved but nevertheless interesting molluscan fossils from a soft red shaly sandstone occupying a stratigraphical position about 20 feet above Middle Eocene beds, from which the species *Ostrea strictiplicata* Raulin and Delbos and *Ostrea cizancourti* Cox † were collected. The locality is recorded as "Indian Survey Sheet No. 37, road from Khanabad to Kabul, 10 kms. (by road) south of Aliabad." Overlying the soft red sandstone was a coarse conglomerate.

The following is a list of the molluscan fossils obtained from the sandstone and described in the present paper :—

Cordiopsis cf. *incrassata* (J. Sowerby),
Psammotæa cf. *fischeri* (Hébert and Renevier),
Psammotæa sp.,
Thracia sp.,
Calyptræa sp.,
Natica sp.

A fragment of an indeterminate decapod crustacean was also found in this bed.

The most interesting member of this assemblage is undoubtedly the species recorded as *Psammotæa* cf. *fischeri*. *P. fischeri* itself, from which this form appears to differ only in size, is a peculiar species which occurs in the Priabonian and Oligocene of the Alpine region of Europe and has also been recorded from the Oligocene of Egypt. The specimen recorded as *Psammotæa* sp. also appears to be closely related to certain European Upper Eocene and Oligocene forms, particularly *Psammotæa binotata* (v. Koenen), from the lower Oligocene of northern Germany and southern England. *Cordiopsis incrassata* (J. Sowerby), a species to which another of the specimens from Afghanistan is most probably referable, has a long vertical range, but is particularly abundant and very widely distributed in the Oligocene.

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* Full references to the literature are given in my previous paper (1938).

† The beds seem to belong to the "Tashkurghan Series," a formational term proposed by Griesbach (Rec. Geol. Surv. Ind. vol. xx. pp. 17–26, 1887), although this "Series" was originally thought to be Pliocene.

These determinations confirm the stratigraphical evidence that the deposit from which these fossils were obtained is probably of Oligocene age. The succession of Oligocene beds overlying the Eocene in certain parts of Turkestan has been described by Russian workers (D. J. Mushketov, 1928, p. 229; O. S. Vialov, 1937, p. 132), and the species of *Ostrea* characterstic of the Oligocene have been most recently described by O. S. Vialov (1937*a*, pp. 29–43). No fossils belonging to the genera recorded in the present paper, however, have been recorded from the Oligocene of that region. Notwithstanding the rather unsatisfactory state of preservation of the specimens now described it is, therefore, thought that their description will prove a useful contribution to our knowledge of the palæontology of Central Asia.

I must express my thanks to Professor M. Lugeon, of Lausanne University, through whose kindness several specimens of the species *Psammotæa fischeri*, including the holotype, have been sent to me on loan for comparison with those from Afghanistan.

DESCRIPTION OF THE FOSSILS.

Class LAMELLIBRANCHIA.

Family **Veneridæ.**

Genus CORDIOPSIS M. Cossmann, 1910.

Cordiopsis cf. *incrassata* (J. Sowerby). (Pl. VII: fig. 1.)

The following are references to descriptions of *C. incrassata*:—

Venus incrassata J. Sowerby, 1817, p. 126, pl. clv. figs. 1, 2.
Cytherea incrassata E. Hébert and E. Renevier, 1854, p. 54.

Cytherea incrassata A. von Koenen, 1894, p. 1259, pl. lxxxvi. figs. 12, 13; pl. lxxxvii. figs. 1–3.
Cytherea incrassata E. Kissling, 1896, p. 54, pl. vi. figs. 1–5.
Cytherea incrassata W. Wolff, 1897, p. 252, pl. xxiii. figs. 13, 14.
Meretrix incrassata G. Rovereto, 1900, p. 100, pl. vii. fig. 5.
Meretrix incrassata J. Boussac, 1911, p. 218, pl. xii. fig. 25; pl. xiii. figs. 10, 12; pl. xiv. figs. 1–4, 9–11.
Meretrix (*Cordiopsis*) *incrassata* L. R. Cox, 1931, p. 81, pl. iv. figs. 7, *a*, *b*.

Material.—One specimen.

Dimensions.—Length 28·0 mm., height 25·0 mm., inflation 14·5 mm.

Remarks.—It seems unnecessary to give a detailed description of this specimen. Its outline is less trigonal than that of most specimens of the species from the English Oligocene, but the species is subject to considerable individual and local variation, and specimens very similar in shape have been figured by some of the authors cited above (for example, Kissling, pl. vi. fig. 2; Boussac, pl. xiii. figs. 10, 10 *a*). In view of the rather poor state of preservation of the specimen, however, it seems advisable to qualify its specific determination.

Although most common in the Oligocene, *C. incrassata* ranges from the Lower Eocene to the Lower Miocene. Details concerning its distribution and further references will be found in my former paper, cited above in the synonymy.

Family **Garidæ.**

Genus PSAMMOTÆA Lamarck, 1818.

Psammotæa cf. *fischeri* (Hébert and Renevier).

(Pl. VII. figs. 2, 3.)

The following are references to descriptions of *P. fischeri* :—

Psammobia fischeri E. Hébert and E. Renevier, 1854, p. 53, pl. ii. fig. 4.
Psammobia fischeri E. Kissling, 1896, p. 52, pl. iv. figs. 35–37; pl. v. figs. 1–4.
? *Psammobia fischeri* G. Rovereto, 1900, p. 111.
Garum fischeri J. Boussac, 1911, p. 229, pl. xii. fig. 1; pl. xiii. figs. 22–24.

Material.—Four specimens.

Description.—The shell is elongate-ovate in shape, tapering posteriorly, to a somewhat variable extent, to an obliquely truncated extremity. It is well inflated for the genus. The umbones are broad and obtuse and level with the postero-dorsal margin; in the two most complete specimens they are placed at about the anterior third of the length, although in a third, less perfect, specimen they lie at about the anterior two-fifths. The postero-dorsal margin is slightly convex and slopes gradually to meet the flattened posterior margin in an obtuse angle. A very obtuse, rounded-off carina runs in an even curve, with an upward-facing convexity, from the umbo to the postero-ventral corner of the shell. The ventral margin is feebly convex or flattened mesially, curving up anteriorly to merge with the parabolically curved anterior margin. The antero-dorsal profile is not at all, or only slightly, concave.

Traces of rather coarse, irregular growth-rugæ are preserved in places.

Dimensions.—The following are the measurements of the best-preserved specimen, which is also the largest: length 62·2 mm., height 33·8 mm., inflation 19·0 mm.

Remarks.—Through the kindness of Professor M. Lugeon I have been able to compare the specimens now described with the holotype of *P. fischeri* (re-figured by E. Boussac, 1911, pl. xiii. fig. 22), from the Priabonian of the Diablerets, together with the topotypes described by E. Kissling (1896, pl. v. fig. 4) and E. Boussac (1911, pl. xii. fig. 1 (showing the hinge); pl. xiii. figs. 23, 24), sent to me on loan from the Lausanne Museum. The Swiss specimens, like those from Afghanistan, show considerable variation, but individual specimens from the two localities agree extremely well in the general shape of the shell. Thus the largest specimen from Afghanistan (Pl. VII. fig. 3) is of almost exactly the same shape as the holotype of *P. fischeri*, while a smaller specimen (Pl. VII. fig. 2), which has a less pronounced posterior taper, is very similar to the topotype represented in Boussac's pl. xiii. fig. 23.

Two of the topotypes bear two obscure, divergent ribs running, with a slight backward inclination, from the umbo to the ventral margin. I can observe no definite traces of such ribs on the specimens from Afghanistan, but the preservation of these specimens is poor.

The specimens which I have seen from the type-locality are all of much the same size, attaining a length of about 40 mm. The largest specimen from the Swiss Middle

Oligocene figured by Kissling (1896, pl. v. fig. 2) is about 53 mm. in length. There is no published information as to whether European specimens ever attain a still larger size. The largest of the specimens from Afghanistan is considerably larger than any of those figured from Europe and, although the species to which they belong appears to be closely related to *P. fischeri*, it seems advisable to qualify its determination.

M. Cossmann (1891, p. 270) considered the species *Psammobia stampinensis* Deshayes (1857, p. 378, pl. xxiii. figs. 13, 14), from the Oligocene of Étampes (France), to be synonymous with *P. fischeri*. In the figured holotype of Deshayes' species the umbones are submedian, whereas in the holotype and other specimens of *P. fischeri* examined by me they are much more anteriorly placed. Until some information is available as to the variability of *P. stampinensis* at its type-locality I think it inadvisable to regard it as a synonym of *P. fischeri*. Cossmann appears to have based his opinion upon the examination of only a single specimen of the latter species.

G. Rovereto (1900, p. 111) further considered *Psammobia aquitanica* Mayer (1858, p. 84, pl. iv. fig. 7), from the Aquitanian of Saint-Avit, near Mont-de-Marsan (France), to be a synonym of *P. fischeri*, but this view is not accepted by F. Sacco (1901, p. 11). The equilateral shape of the figured holotype distinguishes it from that of *P. fischeri*.

Whether or not they are to be regarded as synonymous, these species all appear to belong to the same group, which also includes *Sanguinolaria compressa* J. de C. Sowerby and *Psammobia binotata* v. Koenen, discussed below in connexion with the species from Afghanistan recorded as *Psammotæa* sp. These species resemble one another in the posterior truncation of the shell and the obtusely ridged posterior slope, as well as in the presence of two obscure, divergent ribs which run, with a slight posterior inclination, from the umbo to the ventral margin. Their dentition (best seen in specimens of *S. compressa* from Barton) consists of a moderately strong anterior cardinal and an almost obsolete posterior cardinal in the left valve, and two thin, prominent, non-bifid cardinals in the right valve. The two portions of the pallial line below the deep sinus are united.

The internal characters of these species thus agree better with those of the genus *Psammotæa* Lamarck (frequently regarded as a subgenus of *Sanguinolaria* Lamarck) than with those of *Gari* Schumacher [*Psammobia* Lamarck], in which the anterior tooth of the right valve is bifid. The two divergent ribs, however, are not observable in Recent species of *Psammotæa* or, indeed, of any other genus of the Garidæ except *Zozia* Winckworth [*Azor* Brown], in which they are occasionally developed. Hence it seems probable that this group of Lower Tertiary shells should be assigned to a new subgenus.

In addition to its occurrence in the Priabonian and Oligocene of Switzerland and its possible occurrence (if we accept Rovereto's record) in the Oligocene of Liguria, *P. fischeri* has been recorded from the Oligocene of Egypt; a small Egyptian specimen has been figured by E. Kissling (1896, pl. v. fig. 5).

Psammotæa sp. (Pl. VII. fig. 4.)

Material.—One specimen.

Description.—The shell is subequilateral and subrectangular except for a slight anterior taper; its posterior end is vertically subtruncate. The inflation is rather weak and the valves are flattened mesially. The umbones are very obtuse and not at all prominent. The postero-dorsal margin is feebly convex, sloping gently to meet the feebly convex, subvertical posterior margin in a slightly obtuse angle. The ventral margin is straight except at its anterior end, where it sweeps up in an even curve to merge with the feebly convex anterior margin. The antero-dorsal margin is straight, sloping slightly more steeply than the postero-dorsal margin. An obtuse ridge, coinciding with the most inflated part of the shell, runs from the umbo to the postero-ventral corner. The surface-details are imperfectly preserved, but in the right valve an obscure ridge runs, with a slight backward inclination, from the umbo to the ventral margin. This is probably one of a pair of ribs, the other of which has become obliterated. Traces of uneven growth-threads are preserved in places.

Dimensions.—Length 43·0 mm., height 26·5 mm., inflation 13·0 mm.

Remarks.—This specimen is closely comparable to a species from the Lower Oligocene of Brockenhurst

(Hants.), which has hitherto borne the MS. name *Psammobia arcuata* Edwards in the British Museum collection, but appears to be identical with *P. binotata* v. Koenen (1894, p. 1282, pl. xciii. figs. 6, 7), from the Lower Oligocene of Lattorf and other localities in northern Germany * ; it is, however, slightly less elongate, and is truncated less obliquely at its posterior end. "*Sanguinolaria*" *compressa* J. de C. Sowerby (1824, p. 91, pl. cccclxii.), from the Upper Eocene (Barton Beds) of England, is also comparable, but is decidedly more elongate.

Family **Laternulidæ.**

Genus THRACIA Blainville (*ex* Leach MS.), 1824.

Thracia sp. (Pl. VII. fig. 5.)

Material.—One specimen.

Description.—The shell is equilateral and not greatly elongate, tapering slightly to an angular posterior extremity; its inflation is weak. The umbones are obtuse and of moderate prominence, pointing in a posterior direction. The postero-dorsal margin is feebly convex and slopes at a gentle angle until it merges with the strongly and symmetrically convex anterior margin. The ventral margin is of moderate and even convexity, sweeping up posteriorly to merge with the oblique posterior margin, which meets the straight, sloping postero-dorsal margin in a rounded-off angle, which forms the posterior end of the shell.

The surface of the shell appears to have been ornamented with concentric threads; concentric undulations are absent.

Dimensions.—Length 30·5 mm., height 21·0 mm., inflation 9·3 mm.

Remarks.—In its general proportions this specimen resembles the long-ranging Lower Tertiary species *Thracia bellardii* Pictet †, which has been frequently recorded from the Oligocene, and the German Lower Oligocene species *Thracia scabra* v. Koenen (1894, p. 1320, pl. xciii.

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* The German specimens upon which this species was founded by von Koenen were all more or less incomplete. Of a number of well-preserved specimens from Brockenhurst in the British Museum collection, the largest attains a length of 55 mm. In these specimens the ventral margin is usually nearly flat and has not the obtuse-angled bend shown in von Koenen's restored figures. Otherwise, however they agree well with that author's description and figures.

† See J. Boussac, 1911, p. 241, pl. xv. figs. 1, 13, 14.

figs. 1–3). Its angular posterior extremity, the shape of which is clearly indicated by growth-lines, serves, however, to distinguish it from both of these species, in which the posterior end of the shell is truncated nearly vertically. No species more closely comparable than these two seems to have been recorded from an Upper Eocene or Lower Oligocene horizon.

Class GASTROPODA.

Family **Capulidæ.**

Genus CALYPTRÆA Lamarck, 1799.

Calyptræa sp.

Material.—One specimen.

Remarks.—This specimen is a rather distorted cast, which is too poorly preserved for detailed description or definite determination. It measures 16 mm. in diameter and 12·5 mm. in height, and is characterized by strongly convex sides and a blunt apex.

Its elevated, convex-sided spire suggests comparison with the well-known Eocene species *C. aperta* (Solander) rather than with any European species from an Oligocene type-horizon. F. Sacco (1896, p. 32) has recorded a *Calyptræa* cf. *aperta* from the Oligocene of Cassinello, in northern Italy.

Family **Naticidæ.**

Genus NATICA Scopoli, 1777.

Natica sp.

Material.—One specimen.

Remarks.—This specimen is a very poorly preserved, distorted cast measuring about 12 mm. in height and 14 mm. in diameter, and is characterized by rather square-sided whorls. It is quite indeterminate, and is recorded only to indicate the general generic composition of the fauna.

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EXPLANATION OF PLATE VII.

(All the figures are of natural size.)

Oligocene (?) Lamellibranchia from 10 km. south of Aliabad (Afghanistan).

Fig. 1. *Cordiopsis* cf. *incrassata* (J. Sowerby).
Fig. 2. *Psammotæa* cf. *fischeri* (Hébert and Renevier). Small specimen.
Fig. 3. *Psammotæa* cf. *fischeri* (Hébert and Renevier). Largest specimen.
Fig. 4. *Psammotæa* sp.
Fig. 5. *Thracia* sp.

XXXIII.—*Notes on Species of the Genus* Pectinopygus (*s. l.*). (*Mallophaga*).—I. By GORDON B. THOMPSON.

[Plate VIII.]

Pectinopygus (*Pectinopygus*) *bassani* (O. Fabricius).

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TYPE-HOST.—MORUS BASSANUS (Linn.).

HISTORY OF THE SPECIES.

Müller's name is a *nom. nud.*, and therefore needs no further consideration. Fabricius (1780), whose description reads as follows, was the first person to describe this interesting species :—

" Pediculus Bassani.

Pediculus fuscus capite rotundato, abdomine oblongo-ovato.

Pediculus Bassani, Müll. prodr. 2193.

Grœnl. *Kuksub-koma.*

Descr. Facies et magnitudo formicæ minoris. Totus fuscus, s. ex brunneo nigricans. Caput parvum rotundatum ; thorax gracilis ; abdomen maximum fere-ovatum. Pedes 6.

Habitat in Pelecano Bassano.

Tam retrorsum quæ-antrorsum incedere valet."

Denny (1842) described a species, which he apparently took to be the same as the one described by Fabricius, from specimens collected from *Sula bassana, Phalacrocorax carbo* and *Sterna hirundo.* The specimens from the last two hosts must have been either stragglers or representatives of another species. The latter alternative is likely with regard to those from *P. carbo.* Denny was so struck by the differences between the immature specimens and the adults that he at first took them to be distinct species. He figured both forms. The same author, in the same work, later described and figured a male as a distinct and new species, which he called *staphylinoides*, from the same host. He did not, however, associate the sexes, in spite of their common host. Denny's collection (*vide* Thompson, 1937, p. 81) contains 4 ♀♀, 3 ♂♂, and 1 imm. of his original specimens.

Gervais (1844), under the name *Philopterus bassani*, gave a brief description, which he apparently took from Denny's work, and listed the same hosts as Denny. He also listed *staphylinoides* and gave a figure to which he made the following reference:—"nous en figurions le mâle d'après nature." Denny (1852) merely listed his own two species and gave references to previous works.

The name "*pullatus*," proposed by Giebel (1861), is a *nom. nud.* Five years later Giebel (1866) described a species apparently on the basis of Nitzsch's material, to which the name *pullatus* had been given. The host definitely came from Germany and is quoted as *Sula alba*.

In 1874, Giebel in his 'Insecta Epizoa' quoted Denny's latin diagnosis and the hosts given by the latter. On a later page Giebel quoted Denny's latin diagnosis of *L. staphylinoides*, gave the host as *Sula bassana*, and added that the broad triangular and anteriorly truncate head, the broader thoracic segments, the black colour of the body with light yellow antennæ and legs, characterised this Staphylinoid species. On the same page Giebel described both sexes of Nitzsch's *L. pullatus*, giving the host as *Sula alba*. He did not associate the species described by Denny with his own.

Piaget (1880) redescribed Nitzsch's *pullatus* from *Sula alba* and *Sula fusca* and presented figures of the following:—An adult male, the terminal abdominal segments of a male and a female, the female antenna and the 3rd, 4th and 5th segments of a male antenna. He treated Denny's *staphylinoides* as a variety of Nitzsch's *pullatus*. Piaget's collection contains eight slides of 9 ♀♀ and 7 ♂♂, all determined as *L. pullatus* Nitzsch, off the following hosts:—*S. bassana*, *S. fuscus*, *S. alba*. The specimens from *Sula bassana* must have come into Piaget's hands after he wrote his Monograph, for he does not mention them.

Taschenberg (1882) merely refered to Nitzsch's *pullatus* on p. 143, including it in the group "*clypeati sutura distincta*." Later, on p. 145, he included it in a key to the group. He did not, however, mention Denny's *staphylinoides*, and as the genus *Docophorus* was not included in Taschenberg's Monograph, *bassanæ* was not referred to at all.

Osborn (1896) referred specimens off an unknown host, "probably a Gannett," to Denny's *bassanæ*. Later in this work, Osborn recorded specimens off *Sula bassana* and *Sula alba* from North America, and made the following comments:—" specimens labelled from *Sula alba* lighter coloured than those from *Sula bassana*, but the latter agree perfectly with Piaget's excellent figure. It would seem that Denny's *staphylinoides* must come here, but the specimens do not agree with his description or figure."

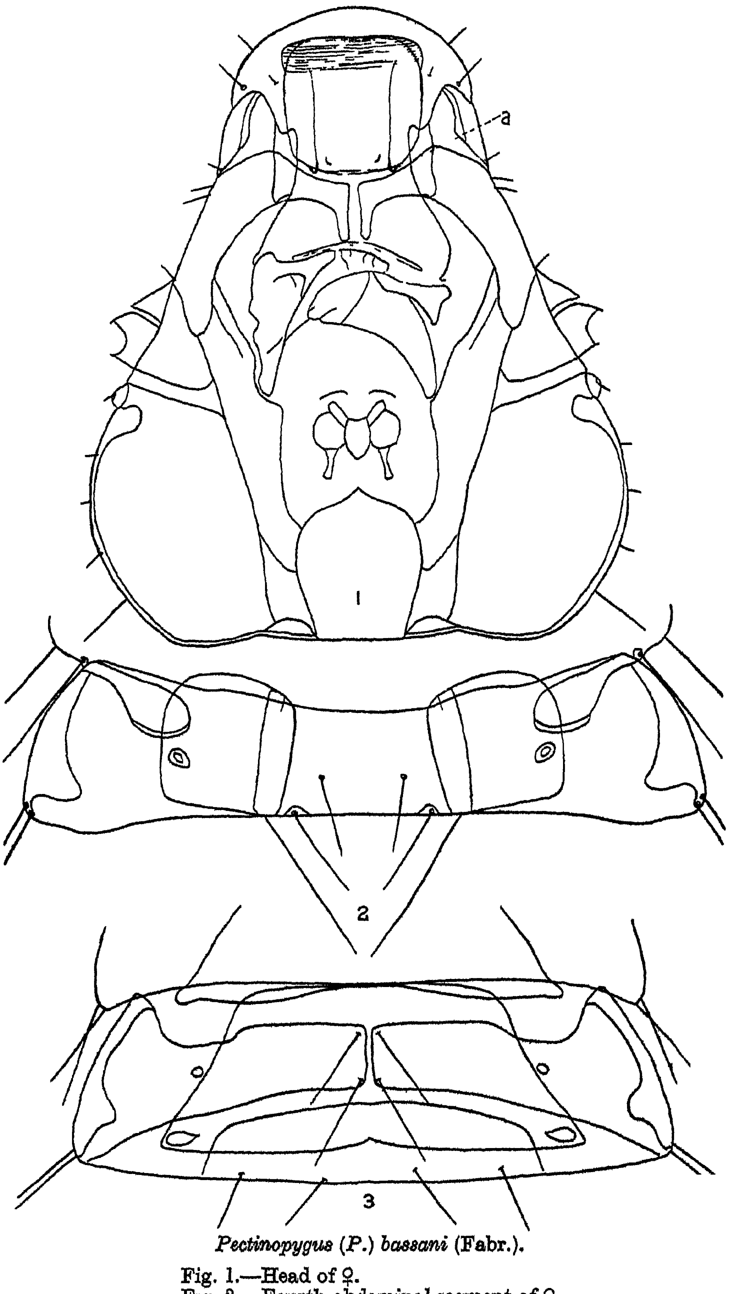
He was the first person to suggest that Denny's *staphylinoides* had some relation to *bassanæ*. Kellogg (1899, Proc. U.S. Nat. Mus. xxii. pp. 41 & 60) merely listed *D. bassanæ* Denny and *L. pullatus* Nitzsch on the basis of Osborn's records. He did not mention *L. staphylinoides* Denny. Evans (1906), quite independent of Osborn's remarks, in recording specimens collected from *Sula bassana* on the Island of St. Kilda, alluded to the resemblance of the females of the species which he determined as *staphylinoides* to Denny's figure of *bassanæ*.

Kellogg (1908) listed Denny's *bassanæ* and Nitzsch's *pullatus*, but omitted Denny's *staphylinoides*. His host records were obviously taken from Osborn's paper (see above) and it is strange that he does not refer to *staphylinoides* (*cf.* Kellogg, 1899, cited above).

In 1910, Mjöberg erected a new genus which he called *Pectinopygus*, with Nitzsch's *pullatus* as the genotype and sole species. He figured a male antenna and the ventral genital plate of the male.

Waterston (1912), after examining a number of specimens off *Sula bassana*, concluded that Denny's *staphylinoides* was the male of *bassanæ*, and that these two were conspecific with Nitzsch's *pullatus*. Evans (1912), on a later page in the same journal, arrived at the same conclusion with regard to Denny's "two" species. In 1914 Waterston, in dealing with *bassanæ* Denny, stated that it represented the female (adult and immature) of Nitzsch's *pullatus*. On a later page the same author recorded *pullatus* from *Sula capensis* and *Phalacrocorax capensis*—the specimens off the second host may be regarded as stragglers. He also added that he preferred to leave *pullatus* in the genus *Lipeurus* rather that accept Mjöberg's *Pectinopygus*, since "the characters upon which the latter were founded were of specific rather than generic value."

Harrison (1916) was the first person to revive Fabricius' name. He gave the host as *Sula bassana* and relegated Nitzsch's *pullatus* and Denny's *staphylinoides* to the synonymy of Fabricius' *bassanæ*.



Pectinopygus (*P.*) *bassani* (Fabr.).

Fig. 1.—Head of ♀.
Fig. 2.—Fourth abdominal segment of ♀.
Fig. 3.—Fourth abdominal segment of ♂.

Cummings (1916) in the same year recorded specimens from *Sula bassana* (Linn.) and *S. capensis* (Licht.) as *P. pullatus* (Nitzsch). He figured and described the male genitalia in great detail.

Bedford (1932) quoted Waterston's South African records, and added that the specimens off *Sula capensis* are probably distinct from Fabricius' *bassanæ.*

Harrison (1937) has since redescribed the genus *Pectinopygus,* extending it to include all the Esthiopterinæ occurring on Sulidæ, Phalacrocoracidæ, Fregatidæ, and Pelecanidæ, with Fabricius' *bassanæ* as the genotype.

Synonymy of the Hosts.

Sula bassana =*Morus bassanus* (Linn.).
Pelecanus bassanus = „ „
Sula alba = „ „
Sula fusca = „ „
Sula capensis =*Morus capensis* (Lichtenstein).

N.B.—See below for remarks on the hosts of this parasite.

Specimens examined.—Males and females off the following hosts: *Morus bassanus* (Linn.), *M. capensis* (Lichtenstein), and *M. s. serrator* (G. R. Gray).

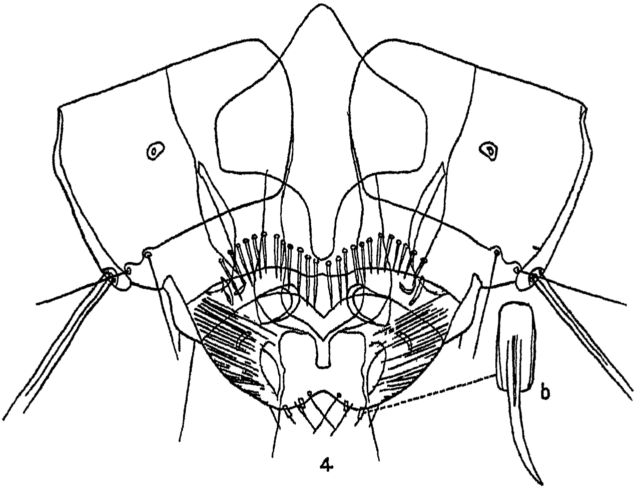
Brief Description.—A stout, strongly sclerotic and deeply pigmented form.

Female (Pl. VIII. f. 1 and t.-f. 1, 2, 3, 7).

Length 2·7 mm.; *greatest breadth* 0·8 mm.

Head: slightly longer than broad. Signature square, well defined, with two small postero-lateral backwardly directed projections (fig. 1 *a*). Clypeal region about one-quarter of the length of the head, suture well defined. Antennal, frontal and inner bands well marked. Trabeculæ small, antennæ (see fig. 7).

Thorax: Prothorax more than twice as broad as long, with a narrow uncoloured median area and one pustulated hair in each posterior-lateral angle. A distinct bar from the outer margin, passing inwards and anteriorly around each coxa. There is a small spear-head shaped sternite on the anterior median area and two small hairs on the posterior margin on either side of the median line. Metathorax slightly narrower than the head at its greatest width, slightly less than twice as wide as long, with an uncoloured median line. Inwards from the posterior-lateral angles, each of which bears one fairly long pustulated hair and a small spine, is an uncoloured area bearing three long pustulated hairs and two smaller ones. Posterior margin slightly convex on abdomen. On either side there is a well-defined lateral bar. Sternite spear-head shaped with point directed posteriorly, bearing two small hairs on its posterior portion. Slightly anterior to the posterior margin on the ventral side are two small hairs situated medianly.



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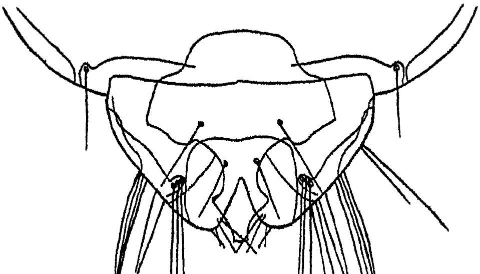

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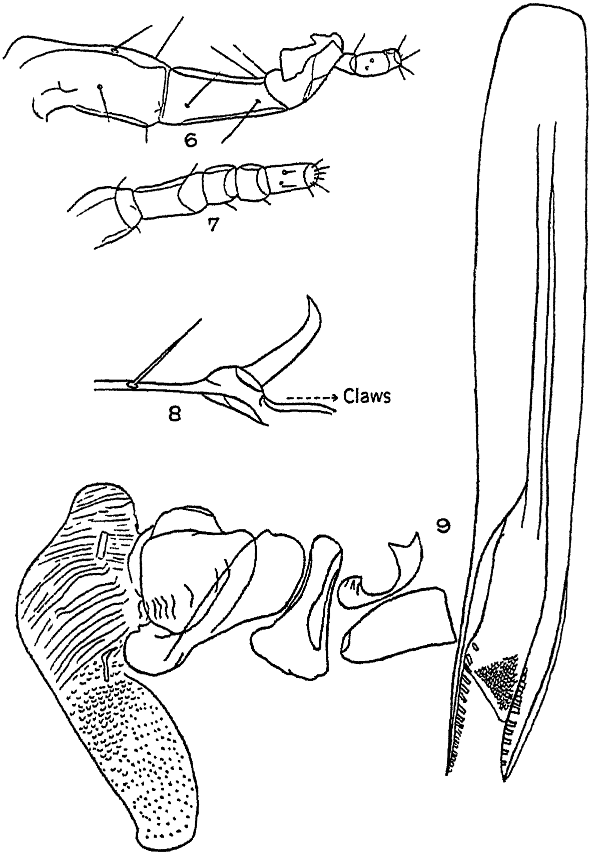
Pectinopygus (*P.*) *bassani* (Fabr.).

Fig. 4.—Genital region of ♂.
Fig. 5.—Genital region of ♀.

Legs: stout and bearing powerful claws. On the postero-ventral aspect of each tarsus is an almost apical group of peculiar broad spines which are slightly hooked at the end. These were mentioned by Waterston (1912,

p. 250), but are by no means easy to find in all specimens. They are, however, more distinct on the mid and hind tarsi, as pointed out by Waterston (*op. cit.*). I give a drawing of one of these spines, highly magnified, from the mid tarsus (see fig. 8).



Pectinopygus (*P.*) *bassani* (Fabr.).

Fig. 6.—Antenna of ♂.
Fig. 7.—Antenna of ♀.
Fig. 8.—Specialised spine on posterior margin of mid-tarsus.
Fig. 9.—Genitalia of ♂.

Abdomen: stout, slightly less than twice as long as greatest breadth. Apparently widest at fifth segment. Transverse bands rectangular, not continuous, with a clear median space which is only moderately pigmented. Spiracles clearly visible. Tergites each bear four long hairs at their postero-lateral angles, a single hair inwards on the postero-lateral margin and in the postero-median angle. Outer margins of segments heavily chitinised and pigmented. Sternites only moderately pigmented, transverse, continuous, but not reaching to the lateral margins, with two hairs on the posterior margin and a median pair at about two-thirds of the length. Terminal abdominal segments (see fig. 7). An enlarged figure is given of one of the sheathed hairs (fig. 7 *b*).

MALE (Pl. VIII. f. 2 and t.-f. 3, 5, 6, 9).

Length 3·2 mm.; *greatest breadth* 0·77 mm.

In general form resembling the female. It is larger, however. The head is about as broad as long. There are no superficially clear areas apparent on the abdomen. The antennæ, genitalia, and terminal abdominal segments are very distinctive (see figs. 6, 9, & 4). The figures presented should render its recognition an easy matter.

N.B.—All the figures, save figs. 4 *b* and 8, are drawn to the same scale. The photographs are approximately ×24. The figures are approximately ×240. All the illustrations and descriptive notes have been made from specimen of *P.* (*P.*) *bassani* (O. Fabr.) collected from the type-host, *i. e.*, *Morus bassanus* (Linn.).

Since Fabricius' type must be taken as lost, I am proposing to make neotypes and neo-paratypes as follows:—

♂ and ♀ neotypes, off type-host, Devonshire, Plymouth, 19. xi. 1935. Numerous neo-paratypes off the type-host from the same locality, from Grassholm, 7. viii. 1934, and Ornkey Is., Hoy, 5. viii. 1938.

NOTES.—When first considering the *Pectinopygus* occurring on species of the genus *Morus*, I was inclined to treat them as one species. A more careful examination has induced me to apply subspecific names to the forms occurring on *Morus serrator* (G. R. Gray) and *Morus capensis* (Lichtenstein). The differences are only slight and are mostly concerned with measurements, but they do seem to be fairly constant. The typical form, which must be the species found on *Morus bassanus* (Linn.), is the largest. *Morus capensis* (Lichtenstein) carries the smallest form, and the one occurring on *Morus serrator* (G. R. Gray) is intermediate between the two. I have been unable to find any marked differences in the male genitalia, but it must be borne in mind that in dealing with such complex genitalia differences may easily be overlooked.

The following table of approximate measurements will serve to illustrate the differences referred to above :—

Host.	*Length.*	
	♀.	♂.
M. bassanus (Linn.)	2·7 mm.	3·2 mm.
M. s. serrator (G. R. Gray)	2·6 ,,	3·0 ,,
M. capensis (Lichtenstein)	2·5 ,,	2·9 ,,

The species occurring on these three hosts will in future be referred to as follows :—

a. *Pectinopygus* (*P.*) *bassani bassani* (O. Fabricius).
Type-host.—*Morus bassanus* (Linn.).

b. *Pectinopygus* (*P.*) *bassani serrator*, subsp. n.
Type-host.—*Morus s. serrator* (G. R. Gray).
♀ and ♂ types and numerous paratypes off the type-host from Tasmania, Storey's Creek, 7. iv. 1938.

c. *Pectinopygus* (*P.*) *bassani capensis*, subsp. n.
Type-host.—*Morus capensis* (Lichtenstein).

♂ and ♀ types and paratypes off the type-host from S. Africa.

I have not seen specimens from the subspecies *Morus serrator rex* (Matthews and Iredale), but it is very probable that they will fall within the limits of the new subspecies off the typical host, since this bird is said only to differ from true *serrator* in minute shades of colouring of the head and neck.

EXPLANATION OF PLATE VIII.

Fig. 1. *Pectinopygus* (*P.*) *bassani* (Fabr.), ♀.
Fig. 2. *Pectinopygus* (*P.*) *bassani* (Fabr.), ♂.

XXXIV.—*Contributions to the Herpetology of Afghanistan.* By MALCOLM A. SMITH. (From the Department of Zoology, British Museum (Natural History).)

A SMALL collection of amphibia and reptiles made recently by Mr. Chaworth-Musters in Afghanistan includes a species of particular interest, namely, a new salamander of the genus *Batrachyperus*, hitherto known only from China. Its discovery in Afghanistan indicates no doubt that it will be found also upon the intervening plateau of Tibet.

A small collection made two years ago by Colonel R. Meinertzhagen is also included in this note. Both collections are now in the British Museum (Natural History).

The following localities were collected in; those visited by Mr. Chaworth-Musters are south of the Hindu-Kush, to the west and south of Kabul, those by Col. Meinertzhagen north of that range :—

South of the Hindu Kush :

Paghman, 17 miles W. of Kabul, 8500 feet altitude ; Arbarp, 10 miles W. of Kabul, 7000 feet ; Ghazni, 7000 feet.

North of the Hindu Kush :

Doshi, 2700 feet ; Doab, 5000 feet ; Dana Ghon, 2400 feet ; Bamian, 8000 feet.

AMPHIBIA.

Batrachyperus mustersi, sp. n.

Description of the type (Brit. Mus. 1940.3.1.1).—Costal grooves 13 or 14. Head-width $4\frac{3}{4}$ and head-length $3\frac{1}{2}$ times in length from snout to vent ; snout broadly rounded ; distance between the nostrils $1\frac{1}{2}$ times in the distance between the upper eyelids ; eye-opening shorter than its distance from the end of the mouth ; a prominent labial fold on the upper jaw and another on the lower ; a groove from the eye to the gular fold, which is indistinct. Limbs well developed, the digits overlapping when adpressed ; fingers 2.3.4.1, and toes 3.2.4.1, in order of length, the tips of all covered with horny epidermis. Tail vertically oval at the base, flattening gradually to the tip, which is obtusely pointed. Skin smooth. Vomerine teeth in two arched series between the choanæ, 8 or 9 teeth in each series, the two almost touching one another in the mid-line, and externally reaching to the level of the inner margins of the choanæ.

Grey above, indistinctly speckled with darker, paler below.

Head and body 66; tail 60; length of head 18; width of head 14; arm 17; leg 22; depth of tail at middle 8 mm.

This new species is closely related to *B. pinchoni*; it differs from it in the more numerous vomerine teeth, in the shorter distance between the two series, and in the feebly marked gular fold.

The genus now contains three species. Chang ('Contribution a l'étude morphologique, biologique et systematique des Amphibiens urodèles de la Chine,' 1936) has regarded *B. tibetanus* Schmidt, as identical with *B. pinchoni*, but if Schmidt's measurements of the proportions of the head and body are correct, they are not the same as those of *pinchoni*. The British Museum possesses two topotypes, if not some of the actual types, received from Père David by the Museum of Natural History in Paris in 1875. In their proportions they agree with the new species.

Paratypes (Brit. Mus. 1940.3.1.2–5).—Three additional specimens, females, agree in all essential characters with the description given. The gap between the two series of vomerine teeth may be a little larger than in the type. A juvenile, incompletely metamorphosed, with the gills still fully developed, measures 43 mm. from snout to vent.

The types were collected in the mountain streams of the Paghman Range, above Paghman, at between 9000 and 10,000 feet altitude, and according to Mr. Chaworth-Musters it was a fairly common species there. I have pleasure in naming it after him.

Bufo viridis Laurenti.

4 exs., Paghman, June 1939; 1 ex., Doab; 1 ex., Bamian. The females from Paghman have ripe ova, ready for expulsion.

Rana sternosignata Murray.

4 ♀♀, Arbarp, July 1939. The species has not previously been recorded from Afghanistan, but is common at Quetta in Baluchistan.

Rana ridibunda Pallas.

1 ex., Doshi.

REPTILES.

Agama caucasica Eichwald.

1 ex., above Paghman, Sept. 3, 1939; 3 exs., Doab; 3 exs., Bamian.

Agama agilis Olivier.

6 exs., Ghazni, July 1939.

Agama ruderata Olivier.

Agama ruderata baluchiana Smith, Fauna Brit. Ind. ii. 1935, p. 223.
Agama megalonyx Günther, Rept. Brit. Ind. 1864, p. 159.

4 exs., Ghazni. *A. ruderata* belongs to the group of species in which the dorsal scales are unequal, the small ones being intermixed with large ones. The four specimens collected show considerable variation in the size and arrangement of the enlarged scales, and in the disposition of the colour pattern, so much so that I must now regard my *A. r. baluchiana* and *A. megalonyx* Günther, both based on single individuals, as identical with *ruderata*.

The precise locality of origin of *A. megalonyx* is not known, but Capt. Griffiths, who obtained it, was present at the taking of the town of Ghazni, and it is known that he collected in the vicinity. See also Günther's remarks on the type-locality (p. 159).

Ophisaurus apodus Pallas.

1 ex., Doshi; 1 ex., Dana Ghon.

Eremias velox persica Blanford.

9 exs., Ghazni; 1 ex., Arbarp.

Eremias guttulata watsonana Stoliczka.

1 ex., Arborp.

Coluber ravergieri Ménétries.

1 ex., Bamian.

Natrix tessellata Laurenti.

3 exs., Dana Ghon.

XXXV.—*The Upper Valentian Ostracod Fauna of Shropshire.* By J. C. HARPER, B.Sc., D.I.C., A.R.C.S.

[Plate IX.]

CONTENTS.

		Page
I.	Introduction	385
II.	Stratigraphical Succession	386
III.	General Account of the Ostracoda and Orientation of the Carapace	386
IV.	The Ostracod Fauna	389
V.	Conclusions	396
VI.	Acknowledgments	397
VII.	References	398
VIII.	Explanation of Plate IX.	399

I. INTRODUCTION.

Nearly one hundred years have passed since McCoy described the first ostracod to be recognized in British rocks; this was *Beyrichia klœdeni* from the Upper Llandovery beds of Cong, Co. Galway, Ireland (McCoy, 1846, p. 58). Many other Silurian forms have been described from the British area since then, mainly by Rupert Jones and Holl in the latter part of the last century, but the large majority of these were from Salopian beds, and the comparatively few Valentian species were all from localities outside Shropshire. This lack of information, which applied to nearly all fossils of the age in question, was no doubt mainly due to the confusion which prevailed at one time over the term " Caradoc Sandstone " (Whittard 1938, p. 86), and when the latter horizon was split up into its true components it so happened that the described species of Valentian age were few in number. The majority of British ostracods since described have come from the Malvern area, and thirteen species are recorded from the red Llandovery shales of the Malvern Tunnel (Smith, J., 1892, pp. 134–158). Two of these forms had been previously dealt with, viz. *Bythocypris symmetrica* (Jones, 1887 *a*, p. 186) and *Primitia lenticularis* (Jones and Holl, 1886, p. 408). Jones gave an account of *Beyrichia klœdeni* from the Llandovery sandstone of Howler's Heath, near Malvern (1881 *a*, p. 345); this is said to be the only other undoubted occurrence of the species outside Galway (Straw, 1928, p. 202). *Leperditia hisingeri* has also been described from Eastnor (Jones, 1881 *b*, p. 333). Two other papers give accounts of species from the Southern Uplands of Scotland (Jones, 1893, p. 297; Jones in Nicholson and Etheridge, 1880). This meagre list would seem to include all the known literature on the subject, and thus, as far as can be ascertained, there has been no account given of any of the forms which abound in parts of the extensive outcrops of Upper Valentian rocks of Shropshire. Some ostracods have been listed in general faunas, but most of them have been ascribed to *Beyrichia klœdeni* McCoy, which actually is not known from the area.

The Upper Valentian fossils of Shropshire are at present being investigated by various workers, and accounts have already been published of the following groups, viz., the corals (Smith, S., 1930), the trilobites (Whittard, 1938), and the gastropods (Pitcher, 1939).

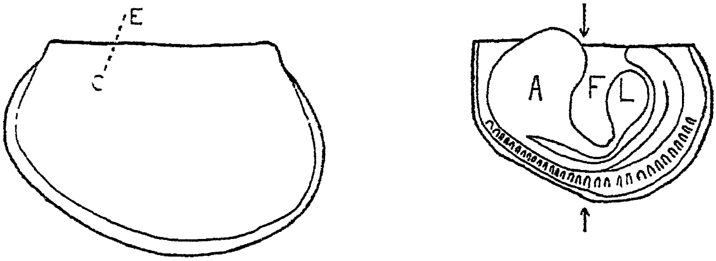
II. STRATIGRAPHICAL SUCCESSION.

The material dealt with in the following account comes almost entirely from the Main Outcrop of the Valentian, which lies to the west of Wenlock Edge. A few specimens have been found in the more sandy beds of the Longmynd-Shelve area to the south and west of the Longmynd. The stratigraphical succession shows a subdivision into the Pentamerus Beds succeeded by the Purple Shales: in the former, arenaceous and mudstone phases are recognized. As far as the Main Outcrop is concerned, the fossils come almost entirely from limestone bands and mudstones, the sandstones and grits of the arenaceous beds having been laid down apparently under conditions inimical to the life of ostracods. In the Longmynd-Shelve area ostracods are rare in all the beds with one important exception. This is the sandy shore-line deposits of the Pentamerus Beds near the southern end of the Longmynd, by Hillend Cottage, where there exists a peculiar fauna containing lamellibranchs and ostracods of a type unknown elsewhere in the district. The stratigraphy has been described in detail by Whittard (1928, 1932).

III. GENERAL ACCOUNT OF THE OSTRACODA AND ORIENTATION OF THE CARAPACE.

The ostracods are crustaceans, usually of small size, in which the soft parts are enclosed in a bivalved carapace of horny or calcareous composition. It is this carapace which is found in the fossil state. The soft parts, which are in the main of little importance from a palæontological point of view, consist of an indistinctly segmented body with seven pairs of lateral appendages, the latter being used for swimming or creeping. Two large lateral eyes are usually present in an anterior position. The only other important organ is the adductor muscle which closes the valves. The eyes and adductor muscle are of some importance in the orientation of the valves as they may leave indications of their presence on the shell.

The valves are placed on the right and left sides of the animal respectively and are articulated along their dorsal edges, whilst they are free ventrally. The determination of anterior and posterior ends in some fossil forms is at the moment a matter of controversy, and a brief account of the opposing views is given below. The shell in modern forms has a more or less evenly convex surface, whereas many fossil types have a lobed surface and the number and position of these lobes and the intervening furrows are of classificatory value. The data for orientation which were used until quite recently were summed up by Ulrich and Bassler (1908, pp. 280–283) and later by Bassler and Kellett (1934, pp. 9 and 10). In the former paper the Palæozoic genus *Leperditia* is taken as showing a number of important characters bearing upon the problem of orientation (see text-fig. *a*). The genus has a small raised



(*a*) (*b*)

(*a*) *Leperditia* sp., left valve. E, eyespot (after Ulrich & Bassler, 1923). (*b*) *Beyrichia* sp., left valve. A, anterior lobe. L, median lobe. F, median furrow (after Ulrich & Bassler, 1908). The two arrows indicate a line drawn perpendicular to the hinge at the mid-length.

tubercle at one end of the shell, near the dorsal margin, which is by common consent regarded as an eyespot and would therefore be anterior in position. With this knowledge it can be seen that the outline of the carapace has a backward swing and that the anterior end of the shell is less deep than the posterior extremity. Most ostracods, however, are without eyespots and thus, in a form such as the Palæozoic *Beyrichia*, it is the backward swing of the carapace which is primarily used for orientation. This evidence is also supported by the posterior position of the globular brood-pouch which is seen in the female forms of *Beyrichia* and allied genera. Less definite swellings are also found in a postero-ventral position in some modern types and are known to be brood-pouches. It is argued that such pouches would naturally be placed posteriorly, and in any case would be a hindrance if placed at the anterior end of a free-swimming animal (Kummerow, 1931, p. 155). If the animal is then oriented by these data it is seen that the " median " furrow (text-fig. *b*, F) lies behind the mid-length of the valve, and the median lobe (L) is therefore posterior in position. Also the median sulcus or furrow is wider than the posterior one. Bonnema, however, in two important papers (1932, pp. 288–293, and 1930, pp. 109–120) reverses the usually accepted orientation. He bases his conclusions on the study of modern forms. The adductor muscle in modern forms is nearly always situated anteriorly, and the impression of this muscle may sometimes be seen internally on the median furrow of Palæozoic types such as *Beyrichia*. Thus he concludes that the median furrow is anterior in position, and that therefore the median lobe must be in front of this again. This, of course, makes the brood-pouch anterior in position, which Bonnema thinks is not impossible, as these forms may have been crawling and not free-swimming types. Further complications have been introduced by Swartz (1936, pp. 557–562), who places great value on the brood-pouch as indicating the posterior end of the carapace. In the Klœdenellidæ, by using Ulrich and Bassler's criteria for orientation, this pouch comes at the anterior end of the carapace, whilst in the Beyrichiidæ it comes at what Ulrich and Bassler would call the posterior end. This naturally throws doubt on any particular structure as providing decisive evidence on orientation, and Swartz considers that the matter must be left in abeyance until specimens have been found in which soft parts are preserved, as was the case with one Carboniferous specimen.

In the following account the orientation of Ulrich and Bassler is used.

IV. The Ostracod Fauna.

The type and figured specimens have been presented to the Geological Survey Museum. The following forms are described :—

Leperditia littoralis, sp. n.
—— *arenacea*, sp. n.
Aparchites lenticularis (Jones & Holl).
—— *simplex* Jones.
Apatobolbina sp.
Beyrichia clavata Kolmodin.
—— *glabra*, sp. n.
Jonesites reticulatus, sp. n.
Ctenobolbina diensti Kummerow.
Klœdenia salopiensis, sp. n.
—— *obesa*, sp. n.
Bythocypris (?) *punctata*, sp. n.

OSTRACODA.

Family **Leperditiidæ** Jones.

Leperditia Rouault, 1851.

Leperditia littoralis, sp. n.

(Pl. IX. fig. 1.)

The new species is founded on the internal cast of a right valve, of which the dimensions are: maximum length 18, hinge-length 13·5, and height 10 mm. The outline of the carapace is elongated and ovate, and more or less symmetrical about a line drawn along the greatest length parallel to the hinge. This appearance is due to the fact that the backward swing of the carapace is not so pronounced as in many species of the genus. The eyespot is well marked, and the muscle impression is represented by an ill-defined U-shaped area placed somewhat anteriorly to the centre. There is a moderately wide flange anteriorly and posteriorly, but this dies out along the ventral margin.

Geological Horizon and Locality.—The littoral sandy mudstones belonging to the arenaceous phase of the Pentamerus Beds above Hillend Cottage at the south end of the Longmynd.

Holotype.—GSM : 70318 and 70319.

Leperditia arenacea, sp. n.

(Pl. IX. fig. 2.)

In this form the height is almost equal to the length of the hinge-line, and this gives the carapace a rectangular appearance. There is a marked eyespot, but the muscle impression is not visible owing to the indifferent preservation. A wide flange is present anteriorly and posteriorly, but disappears ventrally, and the shell appears to curve underneath as if to overlap the left valve. The measurements are: maximum length 19·0, hinge-length 13·5, and height 13.0 mm. The new species is founded on the internal cast of a right valve.

Geological Horizon and Locality.—This form occurs together with *L. littoralis* in the Pentamerus Beds above Hillend Cottage. *Leperditia* has not been found elsewhere in the rocks under consideration.

Holotype.—GSM : 70320.

Family **Leperditellidæ** Ulrich & Bassler.

APARCHITES Jones, 1889.

Aparchites lenticularis (Jones & Holl).

(Pl. IX. fig. 3.)

1869. ***Primitia lenticularis*** Jones & Holl, p. 219, text figs. 4 *a–c*.
1889 *a*. ***Aparchites lenticularis*** Jones, p. 385.
1934. ***Primitia ?? lenticularis*** Bassler & Kellett, p. 447.

The species has been widely interpreted, and our specimen (GSM : 70322) appears to resemble the type figure fairly closely, and is certainly near to specimens in the British Museum labelled *A. lenticularis* by the original authors. Carapace is smooth, strongly convex, and nearly ovate. Hinge very short. Anterior and posterior ends not equally rounded.

Geological Horizon and Localities.—The Purple Shales in Harley Brook due south of Domas, and in a limestone near the base of the shales in the brook to the east of Claybrook Farm, Ticklerton.

Aparchites simplex Jones.

(Pl. IX. fig. 4.)

1887 *b*. *Aparchites simplex* Jones, p. 272, pl. xv. figs. 13 *a–b*.

A smooth lenticular form, rather flattened, and with a long straight hinge (GSM: 70321). Curvature of the anterior and posterior ends slightly different.

Geological Horizon and Locality.—The Pentamerus Beds of Morrell's Wood Brook immediately north of Morrell's Wood Farm.

Family **Beyrichiidæ** Jones emend. Swartz.

APATOBOLBINA Ulrich & Bassler, 1923.

Apatobolbina sp.

There is only one specimen of this genus available for study (GSM: 70323). It has a straight hinge and a marked backward swing to the carapace. Surface of valve flat dorsally, but plunging steeply at the ventral margin. Portions of a narrow brim with radial striæ are seen ventrally. The specimen is an internal cast and it is therefore not possible to say if any ornament is present externally. The measurements are: maximum length 0·81, hinge-length 0·59, and height 0·65 mm.

Geological Horizon and Locality.—The Purple Shales of the Onny River Section.

Remarks.—The specimen is too poorly preserved to be figured, but since the genus has hitherto not been recorded from this country it seems worthy of mention.

BEYRICHIA McCoy, 1846.

Beyrichia clavata, Kolmodin.

(Pl. IX. figs. 5–7.)

1869. *Beyrichia clavata* Kolmodin, p. 18, fig. 10.
1887 *b*. *Beyrichia clavata* Jones, p. 2.
1888. *Beyrichia clavata* Jones, p. 339, pl. xxi. figs. 6–9.

Front lobe pear-shaped and projecting beyond the straight dorsal margin as a short horn (GSM: 70324), although not as prominently as shown in Jones's figure (1888, pl. xxi. fig. 6). Median lobe small and globular, separated from the front lobe by a wide and deep smooth furrow and lying in the concavity of the thin crescentic posterior lobe. The latter is also prolonged dorsally into a short horn. Surface of the valves has a granulation of varying coarseness, but never becoming pronounced into tubercles. Valve surrounded by a rather wide concave brim except along the dorsal margin ; the brim is marked by alternating grooves and ridges in the more ventral part, elsewhere it is smooth (GSM : 70324 and 70325). The female (Pl. IX. fig. 7, GSM : 70326) has a globular brood-pouch on the ventral margin underlying the posterior lobe and interrupting the continuity of the brim. In some well-preserved specimens this pouch is seen to be covered with very fine curving striæ.

Geological Horizon and Localities.—Found in the Pentamerus Beds in Morrell's Wood Brook immediately north of Morrell's Wood Farm and in almost any exposure of the Purple Shales, but particularly from the limestone towards the base of the shales exposed in the brook east of Claybrook Farm, near Ticklerton. Good material also occurs in limestones found in Harley Brook south-south-west of Domas, and in shales in Boathouse Coppice Brook north-west of Upper Lodge Buildwas Park, in Harley Brook 30 yards and also 60 yards south of where it joins the Merrishaw Brook, and at the Onny River section. All these localities are in the Main Outcrop. Specimens have also been recovered from the Purple Shales of Plowden.

Beyrichia glabra, sp. n.
(Pl. IX. fig. 8.)

Lobes stopping abruptly against the straight hinge, and not produced into horns. Outline rounded ventrally and with backward swing not strongly marked. Median lobe inclined posteriorly from ventral to dorsal edge. Furrows not strong and covering about two-thirds of the height of the valves. Surface of valves evenly convex and smooth. Brim present and apparently smooth. The measurements are : maximum length 1·67, hinge-length 1·57, and height 0·93 mm.

Geological Horizons and Localities.—The Pentamerus Beds of Morrell's Wood Brook immediately north of

Morrell's Wood Farm, and the Purple Shales at the junction of the Merrishaw and Harley Brooks, in the stream ¼ mile west of the junction of Brook House and Hughley Brooks, and in the Church Preen Brook 55 yards west of its confluence with Hughley Brook.

Holotype.—GSM : 70328.

Remarks.—The new species resembles *B. klœdeni* (McCoy), but differs in having only moderately marked furrows, in its more even convexity, and in the lobes not being produced into horns at the dorsal margin. *B. glabra* differs from *B. clavata* in having a less-marked median lobe, a smooth surface to the valves, a smooth brim, and in the absence of dorsal horns to the anterior and posterior lobes.

Family **Primitiidæ** Ulrich & Bassler emend. Swartz.

JONESITES Coryell, 1930.

Jonesites reticulatus, sp. n.

(Pl. IX. fig. 9.)

Subquadrate, with a straight hinge. Outline of shell with faint backward swing. Surface of valve nearly flat, but raised up ventrally to form a thin marginal flange. A thin U-shaped ridge is present on the antero-dorsal part of the valve, while the surface is covered with a comparatively coarse reticulation. As the shell is so small, the ornament is only seen under high magnifications and good conditions of lighting. The measurements are: maximum length 0·54, hinge-length 0·49, and height 0·30 mm.

Geological Horizon and Locality.—A limestone in the Purple Shales at the Onny River Section.

Holotype.—GSM : 70329.

Remarks.—The species differs from *J. excavatus* (Jones & Holl) as it is not so asymmetrical with regard to a perpendicular to the mid-dorsal margin, and there is no projection beyond the dorsal margin.

Family **Hollinidæ**, Swartz.

CTENOBOLBINA Ulrich, 1890.

Ctenobolbina diensti Kummerow.

(Pl. IX. fig. 10.)

1924. *Ctenobolbina diensti* Kummerow, p. 431, pl. xxi. (printed as xx.) fig. 8.

Valves small and almost semicircular, with a long straight hinge. An ornament of fine, closely-packed granules is present on the valves. A median reversed S-shaped sulcus runs from the dorsal margin to the ventral border. Behind this sulcus is a small indistinct lobe situated near to the ventral margin. The latter is furnished in the female with a wide radially undulating brim, which is covered with fine curved striæ (Pl. IX. fig. 10, GSM: 70330). At the front and hinder ends just below the dorsal margin are about six fine projecting spines lying in the plane of the valves (GSM: 70331). The measurements are: maximum length 1·05, hinge-length 0·86, and height 0·62 mm.

Geological Horizon and Localities.—Present in the Purple Shales in Hughley Brook, Hughley, just west-north-west of the Mill and also almost due north of the Rectory, in Harley Brook 60 yards south of where it is joined by the Merrishaw Brook, at the Onny River Section, and in a limestone near the base of the shales in the brook on the east of Claybrook Farm, near Ticklerton.

Family **Zygobolbidæ** Ulrich & Bassler.

Subfamily *KLŒDENINÆ* Ulrich & Bassler.

KLŒDENIA Jones & Holl, 1886.

Klœdenia salopiensis, sp. n.
(Pl. IX. figs. 11–13.)

Valves subrectangular in outline and rather compressed laterally; this character is unusual in the genus. Height greater at posterior than at anterior end. Backward swing of carapace but feebly marked. Surface of valves covered with a coarse tuberculation (Pl. IX. figs. 11–13, GSM: 70332–70334), and in one specimen the tubercles are seen at the dorsal margin to be produced into short spines, which suggests that all the tubercles may be the bases of broken-off spines. The ventral brim is radially ribbed, and may be composed of fused spines, each spine being represented by one of the ribs. In the female, the large oval brood-pouch has a similar tuberculation to the rest of the shell. The median sulcus is wide and shallow, and slightly greater than half the height of the shell. The median lobe is small and oval in shape, and does not quite reach the dorsal margin. The posterior sulcus is narrower and more shallow than the median one. The measurements are: maximum length 2·2, hinge-length 1·7, and height 1·3 mm.

Geological Horizon and Localities.—Common in the Purple Shales in Harley Brook south-south-west of Domas, 30 yards and also 60 yards south of where it is joined by the Merrishaw Brook, and at its junction with the latter.

Syntypes.—GSM : 70332 and 70333.

Remarks.—The species exhibits a similar ornament to that found in *K. scotica* (Jones & Holl), but differs in its greater length and in the character of the ventral border, which is granulated in *K. scotica*. From *K. tuberculata* (Salter) the new species may be differentiated by the moderate convexity and the radially ribbed brim.

Klœdenia obesa, sp. n.

(Pl. IX. figs. 14 & 15.)

The hinge is straight. The valves are swollen and plunge down abruptly at the ventral margin, especially in the more posterior part of the carapace. Sulci are shallow, the posterior being longer than the anterior one; both are confined to the dorsal half of the valve. The posterior lobe is produced into a short horn at the dorsal margin. A narrow brim is present and has a knotted or ropy appearance. The surface of the valves is covered with a few scattered tubercles, which are comparatively coarse. The female is provided with a large oval brood-pouch which is also tuberculate. The measurements are: maximum length (including brim) 1·94, hinge-length 1·73, and height (including brim) 1·67 mm.

Geological Horizon and Localities.—Found in the Purple Shales in Harley Brook due south and also south-south-west of Domas.

Syntypes.—GSM : 70335 and 70336.

Remarks.—The species differs from *K. salopiensis* mainly in the much greater convexity, in the narrow brim, and in the wider spacing of the tubercles. There is some resemblance to *K. tuberculata* (Salter), but the brim is wider.

Family **Bairdiidæ** Lienenklaus.

BYTHOCYPRIS Brady, 1880.

Bythocypris (?) *punctata*, sp. n.
(Pl. IX. fig. 16.)

The dorsal margin is convex and the ventral edge straight. Anterior end is broadly rounded, whilst the posterior is rather more pointed. The left valve overlaps the right in the middle of the ventral margin. Valves convex and smooth, but covered with widely-spaced shallow, minute punctæ. The measurements are: maximum length 2·0 mm. and height 1·06 mm.

Geological Horizon and Locality.—Pentamerus Beds of Morrell's Wood Brook immediately south of Spout Lane.

Holotype.—GSM: 70337.

Remarks.—The material is difficult to place in any described genus; it seems to approach *Bythocypris* most closely.

There are many other cyprid-like shells in the Purple Shales, but it is not possible to give any satisfactory account of them as the recognition of most of these genera depends on the overlap of the valves and on the internal details, which cannot be seen in the material collected owing to indifferent preservation.

V. CONCLUSIONS.

Most of the forms described are new to the British Isles, and some are entirely new species. Those described previously from abroad include *Beyrichia clavata* Kolmodin, *Ctenobolbina diensti* Kummerow, and *Aparchites simplex* Jones. The first-named is abundant in the Wenlock Shales of Gotland, but had not before been recorded from this country; that it does not occur in the Wenlockian deposits of Britain seems probable because Rupert Jones makes no record in his many papers on the Wenlockian ostracod fauna. The second species is also new to this country, having first been obtained in the North German Drift from blocks of Wenlockian rocks (graptolithen gestein). The third species is known from the Valentian beds of Gotland. The only form in the faunal list previously described from Britain is *Aparchites lenticularis*, and this was recorded from the base of the Woolhope Shales. Three of the species enumerated above are found in the Wenlockian rocks, and this is significant in view of the remarks made by Professor Whittard (in Smith, S., 1930, p. 330) that the fauna of the Purple Shales shows pronounced affinities with that of the Wenlockian beds.

The ostracods are confined almost exclusively to the Purple Shales, and, moreover, to the mudstone and limestone developments at this horizon ; a few forms occur in the Pentamerus Beds of the mudstone phase. The scarcity of ostracods in the sandy deposits may be attributed to unfavourable conditions of life and not to lack of preservation, for in many localities throughout the Valentian outcrops of Shropshire other fossils are excellently preserved. This view is also supported by the fact that where ostracods do occur in any number in sandy beds, as at Hillend Cottage in the Pentamerus Beds, they are of a kind unknown elsewhere in the area, that is, they belong to *Leperditia.* The occurrence of *Leperditia* was noticed by Kiaer (1908, p. 547) who thought that *L. hisingeri* var. *abbreviata* was present ; the species has not been collected on this occasion. It should be noticed that although the ostracods appear to have disliked sandy habitats, species which occur in mudstones are also found in limestones.

A noteworthy absence from the fauna is *B. klœdeni*, which has been regarded as a typical Valentian form. So far it is known with certainty from the Upper Valentian of Co. Galway and of the Malverns.

VI. ACKNOWLEDGMENTS.

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VIII. EXPLANATION OF PLATE IX.

[In figures 5, 14, and 15 the specimens were coated with magnesium oxide for purposes of photography, and in figures 10, 11, and 12 ammonium chloride was used.]

Fig. 1. *Leperditia littoralis*, sp. n. (see p. 389). Internal cast of right valve showing prominent eyespot and flange; muscle impression faintly discernible in a central position. Holotype (GSM: 70318), ×2. Sandy Pentamerus Beds near Hillend Cottage, Plowden.

Fig. 2. *Leperditia arenacea*, sp. n. (see p. 390). Internal cast of right valve showing eyespot and flange. Holotype (GSM: 70320), ×1·76. Same horizon and locality as above.

Fig. 3. *Aparchites lenticularis* (Jones & Holl) (see p. 390) (GSM: 70322), ×16⅔. Limestone near base of Purple Shales in the brook to the east of Claybrook Farm, Ticklerton.

Fig. 4. *Aparchites simplex* Jones (see p. 391) (GSM: 70321), ×20. Pentamerus Beds of Morrell's Wood Brook immediately north of Morrell's Wood Farm.

Fig. 5. *Beyrichia clavata* Kolmodin (see p. 391). Left valve of male showing straight dorsal margin, with horns on the anterior and posterior lobes and concave radially striated brim (GSM: 70324), ×15·2. Limestone near base of Purple Shales in the brook to the east of Claybrook Farm, Ticklerton.

Fig. 6. *Beyrichia clavata* Kolmodin (see p. 391). Internal cast of right valve showing grooves of the brim represented by rods of sediment (GSM: 70325), ×11·2. Purple Shales of the Onny River Section.

Fig. 7. *Beyrichia clavata* Kolmodin (see p. 391). Internal cast of left valve of female showing brood-pouch (GSM: 70326), ×12. Same horizon and locality as above.

Fig. 8. *Beyrichia glabra*, sp. n. (see p. 392). Internal cast of right valve of male showing ventrally a part of the smooth brim. Holotype (GSM: 70328), ×10·3. Purple Shales of Church Preen Brook 55 yards west of its confluence with Hughley Brook.

Fig. 9. *Jonesites reticulatus*, sp. n. (see p. 393). Right valve showing marginal ridge and U-shaped ridge on dorsal half of the valve. Reticulate surface visible. Holotype (GSM: 70329). ×27. From a limestone in the Purple Shales at Onny River Section.

Fig. 10. *Ctenobolbina diensti* Kummerow (see p. 393). Right valve of female showing curved median furrow, granulate surface (which is over emphasized by the ammonium chloride), and undulating brim (GSM: 70330), ×15·6. Limestone near base of Purple Shales in the brook east of Claybrook Farm, Ticklerton.

Fig. 11. *Klœdenia salopiensis*, sp. n. (see p. 394). Left valve of male showing tuberculate surface and ribbed brim. Syntype (GSM: 70332), ×10·5. Limestone in Purple Shales exposed in Harley Brook south-south-west of Domas.

Fig. 12. *Klædenia salopiensis*, sp. n. (see p. 394). Left valve of female with oval brood-pouch. Syntype (GSM: 70333), ×12·5. Same horizon and locality as above.

Fig. 13. *Klœdenia salopiensis*, sp. n. (see p. 394). External mould of female, illuminated to appear as an internal cast, showing tuberculation (GSM: 70334), ×9·1. Purple Shales of Harley Brook, 30 yards south of its confluence with Merrishaw Brook.

Fig. 14. *Klœdenia obesa*, sp. n. (see p. 395). Right valve of female showing brood-pouch and scattered granules on surface of lobes; narrow brim seen in places. Syntype (GSM: 70335), ×9·0. Limestone in Purple Shales exposed in Harley Brook south-south-west of Domas.

Fig. 15. *Klœdenia obesa*, sp. n. (see p. 395). Left valve of male showing narrow knotted brim, and a few granules which usually are a little more abundant. Syntype (GSM: 70336), ×11·9. Same horizon and locality as above.

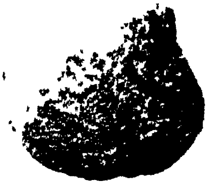
Fig. 16. *Bythocypris* (?) *punctata*, sp. n. (see p. 396). Specimen showing the shape; a few of the scattered punctæ are faintly seen. Holotype (GSM: 70337) ×12·0. Pentamerus Beds of Morrell's Wood Brook immediately south of Spout Lane.

BIBLIOGRAPHICAL NOTICE.

Primitive Insects of South Australia. By H. WOMERSLEY. Adelaide: Frank Trigg, 1939. 322 pp., 84 figs., 2 plates. Price 7*s.* 6*d.*

THIS is the first entomological volume in the series of handbooks of the flora and fauna of South Australia, issued by the South Australian Branch of the British Science Guild (now incorporated with the British Association for the Advancement of Science), and, very appropriately, it deals with the primitive insect orders Thysanura (silverfish), Diplura, Collembola (springtails) and Protura (primitivetails). Until recent years very little was known of the Australian members of these orders, but great progress in their study has been made within the last fifteen years, and the author of the book under review was one of the most proficient contributors to their knowledge. The contents of the book exceed the limits set by the title, since it contains a monograph of the fauna of the whole continent, which is, of course, a great advantage. Keys to families, genera, and species are very abundantly illustrated, since most of the 84 numbered figures contain as many as 20–30 separate drawings. Every species is briefly diagnosed and its distribution recorded. The bulk of the book is devoted to Collembola, which is not only the richest of the orders treated, but is also the most important economically, including a number of very important pests of cultivated plants. Appendices contain instructions for collecting primitive insects, glossary, and bibliography. The book is excellently produced, and its surprisingly low price should make it accessible to wide circles of Australian naturalists.

COX *Ann. & Mag. Nat. Hist. S. 11. Vol. V. Pl. VII.*



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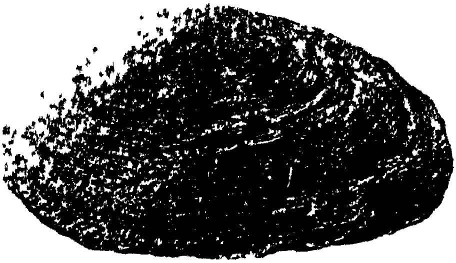

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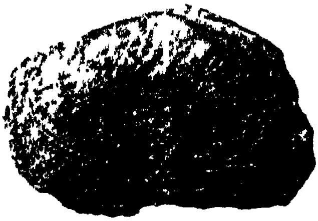

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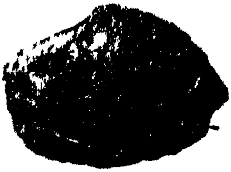

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OLIGOCENE (?) LAMELLIBRANCHIA FROM AFGHANISTAN

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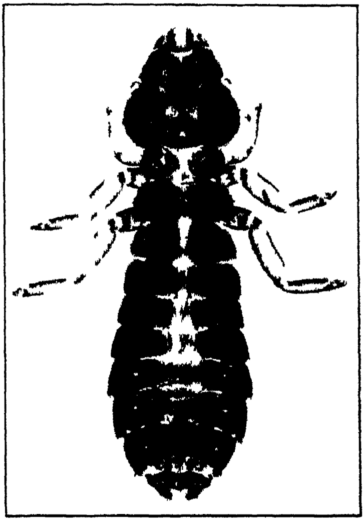

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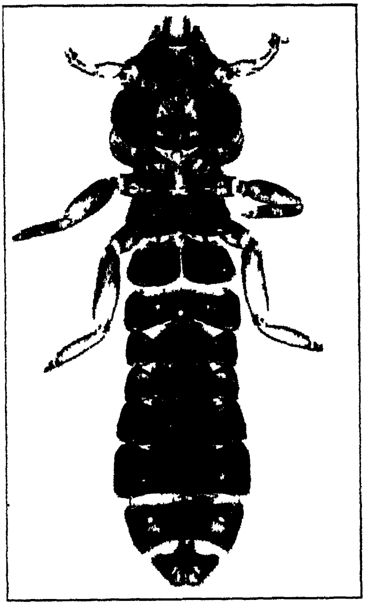

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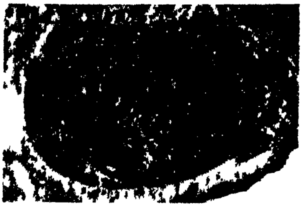
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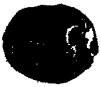
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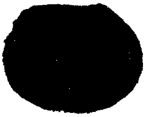
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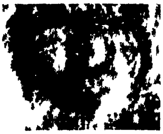
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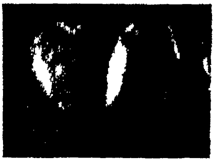
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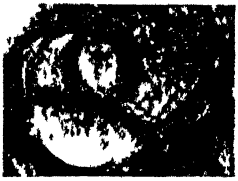
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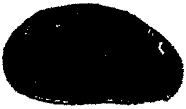
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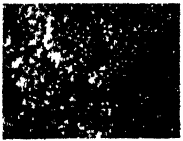
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UPPER VALENTIAN OSTRACODA

THE
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NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 29. MAY 1940.

XXXVI.—*On a further Collection of Parasitic Worms from the Belgian Congo.* By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

DR. H. SCHOUTEDEN, Director of the Belgian Congo Museum, Tervueren, kindly entrusted to the writer a considerable collection of helminths for study and determination. These represent an accumulation of African material obtained by various collectors over a number of years, principally in the Belgian Congo. The bulk of the material consists of Nematodes, but it includes a few representatives of other groups.

The writer's thanks are due to Dr. Schouteden not only for placing the collection at his disposal, but also for the loan of certain type-specimens, and for much help in checking the names of hosts. A few of these proved impossible to identify, but Dr. Schouteden has been able to supply the determinations of the majority of those which were not named on the collectors' labels.

The following is a list of determinations, with morphological notes on some of the less well-known forms, and descriptions of two new species (a Nematode and a Cestode), type material of which will be deposited in the British Museum (Natural History) and in the Musée du Congo belge, Tervueren, Belgium.

NEMATODES.

Family **Ascaridæ.**

Ophidascaris filaria (Duj., 1845).

Collected on three occasions from the intestine of *Python sebæ.*

Polydelphis anoura Duj., 1845.

From *Python sebæ.*

Polydelphis quadricornis (Wedl, 1862).

From *Bitis arietans*, *Naja melanoleuca*, *Boædon olivaceus* and " Dituta " (*Typhlops* sp.).

Toxocara canis (Werner, 1782).

From *Kaupifalco monogrammicus.* A single male, probably a " pseudoparasite."

Toxocara sp.

From intestine of *Python* [*sebæ*]. A single young female, probably a " pseudoparasite."

Porrocæcum sp.

Larval forms from *Clarias bythipogon*, *C. dumerilii* and *Periophthalmus papilio.*

Contracæcum spiculigerum (Rud., 1809).

From *Phalacrocorax capensis* ; Pretoria, S. Africa.

Contracæcum microcephalum (Rud., 1809).

From *Ardea purpurea*; also from several unnamed " wild ducks."

Contracæcum micropapillatum (Stossich, 1890).

From stomach of *Pelecanus onocrotalus.*

Contracæcum sp.

Larval forms, probably of various species, from *Clarias lazera*, *C. platycephalus*, *C. theodoræ*, *Lamprologus cunningtoni* (L. Tanganyika), *Gnathonemus stanleyanus.*

Contracæcum sp.

A single large larval form from *Haplochromis mahagiensis*; Mahagi, L. Albert. This specimen measures about 43 mm. in length, and has a short œsophageal appendix and two intestinal cæca, one long and one short.

Contracæcum sp.

Larval forms from *Clarias gariepinus*, *C. liocephalus* and "Poisson dit 'Monteiro." In these specimens the cuticle shows numerous small, wart-like excrescences, with a tendency to be arranged in transverse rows.

Dujardinia helicina (Molin, 1860) [of Baylis, 1923 (=*D. baylisi* Travassos, 1933)].

Collected on four occasions from the stomach of *Crocodilus niloticus*, and once from *C. cataphractus*.

Dujardinia vandenbrandeni Baylis, 1929.

A single male from the stomach of *Crocodilus niloticus*, among *D. helicina*.

Dujardinia tasmani Ortlepp, 1932.

This species occurred in the intestine of a young *Crocodilus cataphractus* near Irumu [?], Ituri, and in a young *Crocodilus niloticus* at Léopoldville. It was recorded by Ortlepp from the stomach of an unnamed species of crocodile in Southern Rhodesia. His specimens were not fully grown, the females being still immature. The present specimens are about twice as large, as the table of measurements on p. 404 shows. Only one female was present in each set of specimens, but each was fully mature, and the uterus contained eggs.

All the specimens were coiled in a loose spiral. Accurate measurement of the length of the spicules proved impossible, owing to frequent bends, kinks and loops in their course. The tip of the tail of the largest female had been broken off. The writer can add nothing to Ortlepp's description of the caudal papillæ of the male, except that, instead of saying that the four pairs of precloacal papillæ are "unevenly spaced," it would be more correct to say that the intervals between them increase progressively anteriorly, so that the distance between the third and fourth is greater than that between the first and third. Ortlepp's figure of the head shows the outline of the pulps of the interlabia, but not that of their cuticle. The pulp is more or less conical, as he figures it, but the outline of the whole interlabium is much broader and more flattened anteriorly.

	Ortlepp's material. (in mm.)	Present material. (in mm.)
Length of male	up to 25	38–49
Maximum thickness of male	0·56	0·7–0·94
Length of female	14–30	54, 82
Maximum thickness of female	0·7	1·2, 1·4
Œsophagus, length	2·36–2·4	3·2–5·4
Œsophageal bulb, length	0·13	0·16–0·24
,, ,, width	0·2	0·2–0·31
Nerve-ring from anterior end	0·5	0·6–0·94
Tail of male, length	—	0·28–0·35
Spicules, length	up to 8·25	up to at least 13
Accessory piece, length	0·25	0·23–0·25
Tail of female, length	0·45–0·62	0·7, 0·7 [+]
Eggs	—	0·09–0·1 × 0·06–0·07

Multicæcum agile (Wedl, 1862).

From the stomach of *Crocodilus niloticus.*

Amplicæcum involutum (Gedoelst, 1916). (Fig. 1.)

Synonyms :—*Ascaris involuta* Gedoelst, 1916; *Ascaris bufonis* Gedoelst, 1916, *nec* Schrank, 1788, *nec* Gmelin, 1790; *Amplicæcum africanum* Taylor, 1924; *Amplicæcum gedoelsti* Yorke and Maplestone, 1926; *Amplicæcum causi* Thwaite, 1926; *Amplicæcum involuta* Yorke and Maplestone, 1926.

The collection includes specimens which are assigned to this species from the following hosts :—*Bufo regularis*, *Cinixys erosa*, *Causus rhombeatus* (3 sets) and "Serpent 'Kingbanti'"*.

The occurrence in the collection of specimens from *Causus rhombeatus* raised the question of the status of *Amplicæcum causi* Thwaite, from this snake. Through the kindness of Dr. T. Southwell, of the Liverpool School of Tropical Medicine, it has been possible to examine the original specimens of *A. causi*. A pair of co-types of

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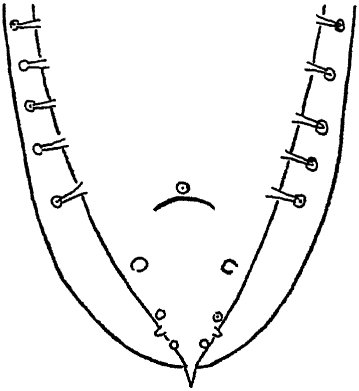
* Dr. Schouteden is unable to determine the identity of this snake.

A. africanum Taylor, which had previously been presented to the Museum, have also been re-examined. Further, through the courtesy of Dr. Schouteden, it has been possible to examine the original specimens of *Ascaris involuta* Gedoelst and *Ascaris bufonis* Gedoelst. As a result of this study, the writer is satisfied that all these forms represent a single species, for which, according to the International Rules of Nomenclature, the name *Amplicæcum involutum* (Gedoelst, 1916) should be used.

Apart from measurements, which are obviously subject to a good deal of variation, the main point of difference in the various descriptions is the number of caudal papillæ in the male. Gedoelst, in *Ascaris involuta* and *A. bufonis*, and Taylor, in *Amplicæcum africanum*, observed only three pairs of postanal papillæ, while Thwaite describes and figures five pairs in *A. causi*. In all the male specimens seen by the writer (including the type material of *A. involuta*, *A. bufonis*, *A. africanum*, and *A. causi*, and the material in the present collection) there were four pairs (fig. 1). The group near the tip of the tail contains three papillæ on each side, as figured by Thwaite, and not two, as indicated by Taylor. On the

Fig. 1.



Amplicæcum involutum.

Posterior end of male ; ventral view (diagrammatic).

other hand, the second pair behind the cloacal aperture figured by Thwaite could not be found, but the median precloacal papilla, shown by Taylor and not by Thwaite, was always present.

Thwaite states that his material included no gravid females, and gives the length of the female as only 15·5–20·6 mm. One female among his specimens was found to measure about 37 mm. in length, and to contain eggs indistinguishable from those of the other forms. The size of the eggs seems to be rather less than that given by Taylor (0·135×0·083 mm.). The writer's measurements of eggs in the uterus of the type-specimens of *A. africanum*, *A. causi*, *Ascaris involuta* and *A. bufonis* gave about 0·11–0·12×0·06–0·07 mm.

The writer was unable to confirm the existence, mentioned by Taylor, of a barb at the tips of the spicules. The length of the spicules varies from about 0·7 mm. to a little over 1 mm., as indicated by the various authors' descriptions. The form of the lips, and the relative coarseness of the teeth on the dentigerous ridges, appear to be the same in all the specimens examined.

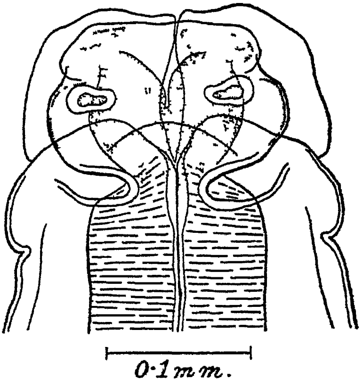
This species appears to have a wide range of reptilian and amphibian hosts. Gedoelst recorded *Ascaris involuta* from *Chamæleon dilepis*, and *Ascaris bufonis* from a "large toad," in the Belgian Congo. Taylor recorded *Amplicæcum africanum* from *Bufo regularis* in West Africa; the present writer (1929) has recorded it from *Rana nutti* and *Natrix olivacea*, and is able to record the same parasite from *Breviceps macrodactylus*, in Tanganyika Territory. Thwaite records *Amplicæcum causi* from *Causus rhombeatus* in Northern Nigeria. Finally there are the hosts recorded for the present collection. The parasite therefore occurs in frogs, toads, snakes, a chamæleon and a tortoise.

Amplicæcum schoutedeni, sp. n. (Figs. 2–4.)

This species occurred in *Varanus niloticus* at Pweto. Adult forms were found in the stomach, and young adults (the females without eggs) in a cavity in the lung. The portion of the lung occupied by the worms appeared to have undergone some pathological modification, but the nature of the cavity in which they lay, or whether it was a closed cavity, is not quite clear from the portion preserved.

Fully adult males measure 18–35 mm. in length and 0·56–0·7 mm. in maximum thickness; females 37·5–45 mm. and 0·9–1 mm. respectively. The specimens from the lung are considerably smaller. The cuticular striations are fine and indistinct, the interval between them being about 4 μ in the middle region of the body. The diameter of the head is 0·15–0·16 mm. in the male and 0·22 mm. in the female. The lips are very similar in shape to those of *A. involutum*, but the dentigerous ridges are very inconspicuous and composed of extremely small teeth, whereas in *A. involutum* the teeth are relatively large and coarse. The pulp of the dorsal lip (fig. 2) is bilobed and appears to have somewhat fan-shaped anterior processes. The interlabia are large but low, and the interlabial grooves at the bases of the lips are well developed. The œsophagus measures 2·3–2·4 mm. in length (measured from the anterior extremity) in the male, and 2·6–3·47 mm. in the female. The intestinal cæcum is 1·3–1·4 mm. long in the male, and 1·65–2·3 mm. in the female. The nerve-ring is situated at 0·45–0·6 mm., and the excretory pore and cervical papillæ at 0·5–0·75 mm., from the anterior extremity.

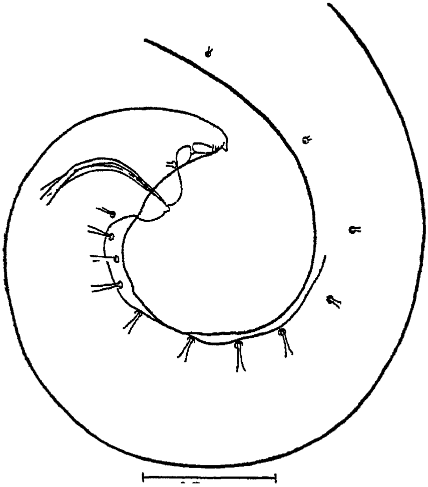
Fig. 2



Amplicæcum schoutedeni.
Anterior end of female; dorsal view.

The tail, in both sexes, is bluntly rounded, but has a conical terminal spike about 0·02 mm. long. In the male the caudal end is ventrally coiled and provided with inflated lateral alæ which tend to curl inwards over the ventral surface, forming a deep groove or gutter. The cloacal aperture is situated on a conspicuous elevation, and on its anterior lip there is a median papilla. The tail is 0·26–0·33 mm. long. The number and arrangement of the caudal papillæ (figs. 3 and 4) are almost identical with those of *A. involutum*. There are four pairs of postanal papillæ, three of which form a group near the tip of the tail. In front of the cloacal aperture there is a row of 13–15 papillæ on each side. The posterior eight or nine of these papillæ have long peduncles projecting into the alæ. The more anterior papillæ gradually become smaller and more widely spaced. The spicules are simple and tubular, and measure 0·55–0·6 mm. in length.

Fig. 3.

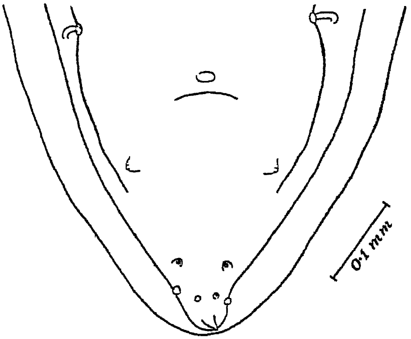


Amplicæcum schoutedeni.
Posterior end of male ; lateral view.

The tail of the female is about 0·3 mm. long, and bears a pair of subterminal papillæ. The vulva is situated at about 13–14 mm. from the anterior end of the body. There is a short, wide, muscular vagina which runs posteriorly from the vulva for a distance of about 1 mm., and is followed by an unpaired portion of the uterus measuring only 1–2 mm. in length. The eggs, as in *A. involutum*, are large and oval, with thin, irregularly wrinkled shells. They measure 0·14–0·17 × 0·072–0·084 mm.

This species differs from *A. involutum*, as already mentioned, in the much less well-developed condition of the dentigerous ridges of the lips. The spicules of the male are also considerably shorter, and the great prominence of the lips of the cloacal aperture is characteristic. In other respects the species are very similar.

Fig. 4.



Amplicæcum schoutedeni.
Posterior end of male ; ventral view.

In *Amplicæcum varani* Baylis and Daubney, 1922, described from *Varanus salvator* in the Zoological Gardens, Calcutta, the caudal alæ are inconspicuous or absent, and there are 32 pairs of preanal papillæ. This species again, however, appears to be very closely related to the form here described.

Family **Heterakidæ.**

Strongyluris brevicaudata Müller, 1894.

From *Agama colonorum.*

Africana africana (Gendre, 1909).

From *Cinixys erosa.*

Family **Kathlaniidæ.**

Spironoura sp.

From *Trionyx* sp. A number of specimens, possibly representing a new species, but in so shrunken a condition, in spite of several attempts at restoration, that description is hardly possible. The male has four "sucker-like organs" in front of the ordinary preanal muscles. The spicules are relatively very stout and measure about 0·7–0·8 mm. in length.

Family **Quimperiidæ.**

? *Gendria* sp.

A single female from the stomach of *Crocodilus niloticus*, perhaps derived from some fish eaten.

Family **Atractidæ.**

Labiduris africana Gedoelst, 1916.

From *Cinixys erosa.*

Family **Mermithidæ.**

Mermis sp.

Immature specimens found in the intestine of a fowl. These were perhaps derived from some insect eaten by the fowl.

Family **Diaphanocephalidæ.**

Kalicephalus ? *nigeriensis* Ortlepp, 1923.

Host, "Serpent A" *, Niemba, Katanga.

In the males the spicules measure about 0 4–0·45 mm., whereas Ortlepp gives 0·37 mm. But he had only one male, which was only 7 mm. long, while the present specimens measure up to about 8·5 mm. It seems not impossible that *K. nigeriensis* may be a synonym of *K. simus* (Daubney, 1923). The type host of *K. nigeriensis* was an undetermined snake from Nigeria; the type host of *K. simus*, *Naja nigricollis*. Most of the measurements of *K. simus*, according to Daubney, are rather larger than those given by Ortlepp for *K. nigeriensis*, but this is to be expected if Ortlepp's specimens were not fully grown.

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* Dr. Schouteden is unable to identify the species to which this refers.

Family **Filariidæ.**

Diplotriæna ? *tricuspis* (Fedchenko, 1874).

From *Camaroptera brevicaudata tincta*.

Diplotriæna spp.

Examples of this genus occurred in *Euplectes xanthomelas* and *Gymnobucco bonapartei*. In the present state of our knowledge of the limits of species in this genus, determination of this material seems impossible.

Family **Philometridæ.**

Micropleura sp.

From the "intestine" of *Crocodilus niloticus*. Two females only. This genus does not appear to have been recorded from African crocodiles. In the absence of a male it is probably impossible to determine whether the species is identical with *M. vivipara* v. Linstow, 1906, which occurs in the Indian gharial.

Family **Spiruridæ.**

Physaloptera affinis Gedoelst, 1916.

(Figs. 5 and 6.)

Several specimens from "Serpent A" *, Niemba, Katanga. The original specimens of *P. affinis*, from *Psammophis sibilans*, have been kindly lent to the writer by Dr. Schouteden for comparison, and the species is undoubtedly the same. The females in the present collection are a little larger, measuring up to 27 mm. in length and 0·98 mm. in maximum thickness. As stated by Gedoelst, there are no denticles on the inner surfaces of the lips. He also correctly states that there is no "fourchette interne." There is, however, a single lancet-shaped tooth (figs. 5 and 6, *i.*) on the inner side of the large, conical external tooth. The smaller submedian teeth (figs. 5 and 6, *s.*) are bifid and curve outwards. These are apparently the structures referred to by Gedoelst when he says "à droite et à gauche de la dent externe, on voit une papille saillante," for he describes in addition the three external papillæ of each lip.

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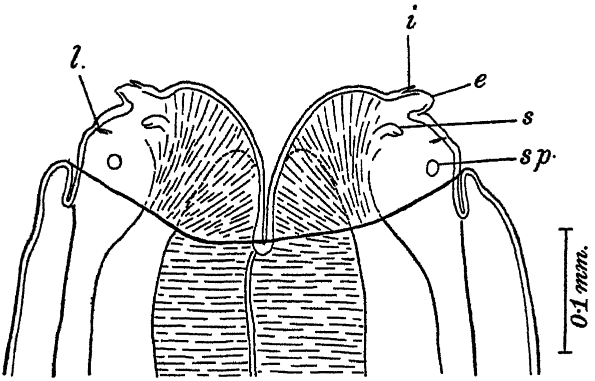
* Dr. Schouteden is unable to identify this snake.

Some of the other measurements are slightly greater than those given by Gedoelst. Thus, the tail of the male measures up to 0·95 mm. in length, and that of the female up to about 0·7 mm. The left spicule of the male, both in the present material and in Gedoelst's types, measures up to 2·5 mm. or more in length (Gedoelst gives 2·2 mm.). The eggs, on the other hand, are slightly smaller in both sets of material, measuring about 0·05–0·054 × 0·032–0·036 mm. (Gedoelst gives 0·056 × 0·04 mm.). Gedoelst does not describe the mode of origin of the branches of the uterus, merely stating that there are four of them. In the specimens examined by the writer they arise by dichotomous branching.

Fig. 5.



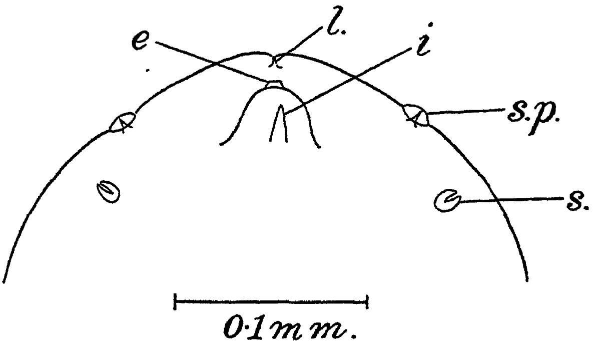
Physaloptera affinis.

Anterior end of female; dorsal view. *e.*, external tooth; *i.*, internal tooth; *l.*, lateral papilla; *s.*, submedian tooth; *s.p.*, submedian papilla.

Ortlepp (1923, *a*) has recorded what he regards as specimens of *P. paradoxa* v. Linstow, 1908, from *Psam-*

mophis sibilans, the type host of *P. affinis*, and " consequently " treats *P. affinis* as a synonym of *P. paradoxa*. As has been shown, however, *P. affinis* has no small denticles on the lips, and the uterine branches originate dichotomously. These, according to Ortlepp, are the principal characters in which *P. varani* Parona, 1889, differs from *P. paradoxa*. There is, therefore, a possibility that *P. affinis*, though evidently distinct from *P, paradoxa*, may prove to be identical with *P. varani*. The writer, however, feels considerable doubt as to the possibility of identifying *P. varani*, and considers it wise for the present to treat *P. affinis* as an independent species.

Fig. 6.



Physaloptera affinis, female.

One of the lips, viewed from the front. *e.*, external tooth ; *i.*, internal tooth ; *l.*, lateral papilla ; *s.*, submedian tooth ; *s.p.*, submedian papilla.

Physaloptera sp.

A single immature female from *Kaupifalco monogrammicus*.

Spirurid larvæ [? Physalopterinæ].

Encysted forms from the peritoneum [?] of *Clarias theodoræ*. The cysts were of an elongate form, with a knob-like expansion at one or both ends.

Family **Gnathostomidæ.**

Tanqua tiara (v. Linstow, 1879).

From *Varanus niloticus.*

Family **Dioctophymidæ.**

Eustrongylides sp.

Larval or preadult forms from the following fishes:—*Clarias theodoræ, C. walkeri, C. lazera,* "Poisson dit Monteiro." Also (apparently a smaller species) from *Lamprologus cunningtoni* (Rumonge, L. Tanganyika).

ACANTHOCEPHALA.

Family **Polymorphidæ.**

Centrorhynchus sp.

Fragments only, from *Kaupifalco monogrammicus.*

CESTODES.

Family **Davaineidæ.**

Raillietina (*Fuhrmannetta*) *vandenbrandeni*, sp. n.

This species was obtained from the common West African grey parrot (*Psittacus erythacus*) at Léopoldville. The material is fragmentary. The longest fragment, which includes a scolex but no fully gravid segments, measures (in Canada balsam) about 100 mm. in length, and has a maximum width of about 1·5 mm.

The scolex has a diameter of 0·22 mm. The suckers are elliptical and measure about 0·13 mm. in length and 0·09 mm. in width. The rostellum (retracted) has a diameter of 0·094 mm., and is armed with a double crown of hooks. Of these there are probably about 120, and their length appears to be about 16–17 μ, but they cannot be accurately counted or measured in the only scolex available. The suckers are armed with about 10–12 alternating rings of spines, which measure about 12–13 μ in length. There is a slender, unsegmented "neck," about 2 mm. long. Throughout the strobila the segments are broader than long, except when gravid. They then become longer and narrower, and are sometimes nearly twice as long as broad.

The genital pores are irregularly alternating. The cirrus-sac is of simple pyriform shape, and measures up to 120 μ in length and 46 μ in width. It does not reach the lateral excretory canals. Its muscular coat is considerably thickened in the narrow distal half. The cirrus is armed with minute spines. There are about 45–55 testes in each mature segment. When fully developed these have a maximum diameter of about 40–50 μ.

The gravid segments contain a closely-packed mass of egg-capsules, occupying the whole of the space between the excretory canals, and sometimes extending, as a single row, beyond the canals on each side. Each capsule contains from one to four eggs, but the most frequent number is two. The onchospheres have a maximum diameter of about 12–16 μ.

This species does not appear to agree with the description of any of the ten species of the subgenus *Fuhrmannetta* from birds listed by Fuhrmann (1932)*, and none of these is recorded from a parrot. So far as the writer's knowledge goes, 14, or possibly 15, species attributable to the genus *Raillietina* have been recorded from parrots, and all these appear to belong to the subgenus *Raillietina*. Two of them, *R. leptosoma* (Diesing, 1850) and *R. taylori* Baylis, 1929, have occurred in *Psittacus erythacus*. "*R. crassula* (Rud., 1819)" seems also to have been recorded from this bird (see Stiles, 1896; Meggitt, 1921), but according to Meggitt this is the *Davainea crassula* of Clerc, 1906, and not Rudolphi's species. *R. crassula* (Rud.) Fuhrmann, 1920, belongs to the subgenus *Fuhrmannetta*, while the "*D. crassula*" of Clerc (now known as *Raillietina clerci* Fuhrmann, 1920) belongs to the subgenus *Raillietina*. Both *R. crassula* and *R. clerci* are normally parasites of pigeons. Stiles, who mentions the record from *Psittacus* without giving its source, suggests that it may have referred to the species now called *Raillietina* (*R.*) *leptosoma* (Diesing, 1850). If not this species, it was probably one of the other 13 species now known from parrots, and there appears to be no reason for supposing that it was a *Fuhrmannetta.*

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* The description of one of these, *R.* (*F.*) *bucerotidarum* Joyeux and Baer, 1928, seems to indicate that it belongs rather to the subgenus *Paroniella*.

The present material is therefore thought to represent a new species, which is named after Dr. Vandenbranden, who collected it.

Family **Dilepididæ.**

Biuterina sp.

Fragments only, from *Syrnium woodfordi nuchale.*

TREMATODES.

Family **Brachylæmidæ** (?).

Harmotrema sp.

Very small forms, probably immature, though some of them were beginning to produce eggs, from *Crocodilus cataphractus.*

Family **Cyathocotylidæ.**

Cyathocotyle ? fraterna Odhner, 1902.

From *Crocodilus cataphractus.*

Family **Strigeidæ.**

Ophiosoma patagiatum (Creplin, 1846).

From *Butorides atricapillus.*

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XXXVII.—*Stray Notes on Mallophaga.*—II. By G. H. E. HOPKINS, M.A.*

5. *The Measurements published by Rudow.*

Rudow's descriptions of Mallophaga are notoriously careless in the extreme, and his names have caused endless trouble in the systematics of the group, especially as most of his types are lost. Unfortunately we cannot ignore these names, and must endeavour to interpret them and make neotypes where necessary.

In the works of the early monographers one frequently meets with a statement that they would have synonymized one of Rudow's names with some other name but for the small size mentioned by Rudow. Similarly the present writer has frequently collected a species from Rudow's type-host and would have felt complete confidence that it was Rudow's species except for the grave discrepancy in size between Rudow's description and the actual specimens. It is, therefore, important to examine whether the measurements given by Rudow bear any relation to reality.

For this purpose we have an invaluable guide in that Taschenberg (1882) redescribed a number of Rudow's species from type-material. In the table below I give for a number of species the length (" Grösse ") given by Rudow in the original description and that given by

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* Published by permission of the Director of Medical Services, Uganda.

Taschenberg, all figures being in millimetres. In the case of *G. carpophagæ* there may be some doubt as to whether Taschenberg's figures were taken from Rudow's material, but there can be very little doubt that Taschenberg's specimens were conspecific with Rudow's, since Taschenberg saw the types and redescribed the species from the same host. A few doubtful cases have been omitted. All the species have been retained in the genera in which Rudow placed them.

Species	Rudow.	Taschenberg.
Goniodes eximius	1	♂ 2·93, ♀ 2·85
Goniocotes fissus	1	♂ 2·39, ♀ 2·75
,, *carpophagæ*	0·25	♂ 1·00, ♀ 1·13
,, *flavus*	0·75	♂ 0·96, ♀ 1·29
Oncophorus schillingi	1·5	1·73
Trichodectes mexicanus	1	1·68
,, *breviceps*	1	1·84
,, *longiceps*	1	♂ 2·04, ♀ 1·93

To the above we may add *Acidoproctus rostratus* (Rudow), of which the type is in the Halle collection. Rudow gave the length as 2·5 mm. in 1866 and 1·5 mm. in 1869; Dr. Kéler very kindly informs me that the type is 2·5 mm. in length.

From the above examples only one conclusion is possible—that Rudow's measurements are the wildest of guesses. They are (at least usually) much below the true measurements, but the error is in no way consistent, *i. e.*, there is no factor by which we may multiply Rudow's measurements and arrive at even an approximately true figure. In any endeavour to interpret Rudow's names the measurements published by him must be ignored.

6. *A further Note on* Rhopaloceras aliceps (*Nitzsch*), *and on some other Mallophaga from* Tinamidæ.

In a previous note (Hopkins, 1938, p. 198) I stated that *Rhopaloceras aliceps* must "be very close to, if not identical with," *Rhopaloceras genitalis simplex* Carriker." Subsequently Mr. Carriker most kindly gave me a pair of paratypes of *R. a. simplex*, and Dr. Kéler has been good enough to compare the male with Nitzsch's type of *aliceps.* He finds my specimen "absolutely identical with" Nitzsch's type, the only apparent difference being that (owing to the accidents of preparation and mounting of the specimens) the temporal lobes in Nitzsch's type are spread out flat, whereas in my specimen they are somewhat curled up and lend the head an illusory appearance of being narrower than in the type.

R. genitalis simplex Carriker is, therefore, an absolute synonym of *Rhopaloceras aliceps aliceps* (Nitzsch).

I also stated that the name *Tinamus* "*macrourus*" refers to *T. major major*, but I now consider that this is not established, and probably incorrect. Kéler (1938, p. 325) has suggested, probably correctly, that the name is a mistake for *Dendrortyx macrourus* and that the specimens were stragglers. This is the more probable as both Tinamidæ and the *Dendrortyx* are game-birds, and might well come into contact in a game-bag or in a Zoological Garden (we know nothing as to the origin of the host of Nitzsch's material). The evidence as to the identity of "*macrourus*" is as follows :—The two species of Mallophaga described from it are *Rhopaloceras aliceps* (Nitzsch) and *Ornicholax alienus* (Giebel). I have shown above that the *Rhopaloceras* agrees perfectly with material from *Tinamus major castaneiceps*, and as we know that other species of *Tinamus* (*serratus* and *tao*) have their own forms of *Rhopaloceras*, it is more than probable that the true host of *R. aliceps* was *Tinamus major* subsp. As regards the *Ornicholax*, the position is different. Clay (1937, p. 158) states differences between the type and material from *T. major robustus*, but notes that a specimen from *T. m. major* appears to agree with the type; she does not mention the genitalia. Kéler (1938, p. 325) places *O. robustus* Carriker (from *T. m. castaneiceps*) as a synonym of *alienus*, and figures the male genitalia of a specimen from *Tinamus solitarius*, which he states agrees in all respects with the male type ; he also thinks Carriker's figures of the male genitalia of *robustus* and its subspecies to be faulty. The species of *Ornicholax* from *T. solitarius* has been described as *Ornicholax solitarius* Guimarães and Lane (1937, p. 3), and their figure of the male genitalia agrees very fairly with that of Kéler of material from the same host ; as the type of *alienus* is a male, and was compared by Kéler with his material from *T. solitarius*, we may safely assume that *O. solitarius* is a synonym of *O. alienus*. But the genitalia of *O. r. robustus* as figured by Carriker do not agree at all well with either of the figures of material from *T. solitarius*. I have not seen material from the latter host, but have before me a series of *O. r. robustus* from *Tinamus major castaneiceps*, the type-host of *robustus*. The series includes three males, one of which has had the genitalia dissected out so that all details can be observed. The genitalia of these males agree excellently with each other and also with Carriker's figure, but differ in several respects from those of the form from *T. solitarius* as figured by Guimarães and Lane and by Kéler. The most obvious difference is that in *O. r. robustus* the parameres are strongly curved, whereas in both the figures of material from *Tinamus solitarius* they are shown as almost straight. It may be regarded as established, therefore, that *O. solitarius* Guim. and Lane is a synonym of *Ornicholax alienus* (Giebel), and that *O. robustus* Carriker is at least subspecifically distinct. It is also probable that the true host of *alienus* (Giebel) is *Tinamus solitarius*. The case is an excellent example of the danger of synonymizing different forms of Mallophaga except on the basis of comparison of types or, at the very least, of specimens from the type-hosts of the forms in question.

I may also take this opportunity to comment on *Heptagoniodes agonus* Nitzsch. The type is a female from *Tinamus tao* and Kéler (*loc. cit.* p. 323) identifies it with specimens of both sexes from *T. solitarius*. Strangely enough, Nitzsch and Kéler appear to have been the only workers on Mallophaga to obtain the female of any species of this genus, unless the sexes of *H. excavatus* (Piaget) are correctly associated, which seems very doubtful *. But from both *Tinamus tao* and *T. solitarius* species of *Heptagoniodes* have been described from the male sex only—*H. mirabilis* Carriker from the former host and *H. clayi* Guimarães and Lane from the latter—and the only really striking differences between these species are in the form of the head (a purely male character in this genus) and of the male genitalia. Kéler figures both sexes from *Tinamus solitarius*, and states that the females agree perfectly with Nitzsch's type. But his figure of the male genitalia is exactly similar to that of the male genitalia of *H. clayi*, and his measurements also agree excellently with those of Guimarães and Lane except that the head-index in their case works out a trifle higher (1·17 as against 1·13), which might easily be due to the pressure of the cover-slip. There is, therefore, no possible doubt that *H. clayi* is the form from *Tinamus solitarius* which Kéler identifies as *H. agonus* (Nitzsch). But is Kéler's form *H. agonus* (Nitzsch)? I claim that there is no real evidence that this is the case. There are numerous instances in which closely-allied species are inseparable in the female sex but quite distinct when we examine the male genitalia, and I consider that, until definite evidence is produced in the shape of female *Heptagonides* from *Tinamus tao*, the only reasonable procedure is to regard *H. mirabilis* Carriker as the male of *H. agonus* (Nitzsch) (from the same host) and *H. agonus* " (Nitzsch) " Kéler, 1938, *nec* Nitzsch, 1874, as a synonym of *H. clayi* Guimarães and Lane.

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* The record of Kellogg and Paine (1911, p. 23, fig. 3) may be dismissed at once, for their figure of the apex of the male abdomen shows a species which almost certainly does not belong to this genus. It appears to be an *Ornicholax*.

7. *Notes on some Mallophaga of the Coot.*

There are on the Common Coot of Europe, *Fulica a. atra* Linné, at least five species of Mallophaga, all belonging to different genera :—*Eulæmobothrion*, *Pseudomenopon*, *Incidifrons*, *Rallicola* *, and *Fulicoffula*.

The first author to record any of these species was Redi (1668), who depicted on his tav. iv. three " Pollini della folaga," of which fig. 1 is the *Eulæmobothrion*, fig. 2 the *Fulicoffula*, and fig. 3 the *Incidifrons*. All these figures are remarkably good, considering the date at which they were drawn, and leave no doubt as to the identity of the species portrayed. In the Latin translation of Redi's works (1729) the same plate is reproduced, and Albin (1736, pl. xliv. fig. [4]) copied Redi's figure of the *Eulæmobothrion* as his " Louse of a Coot."

Linné (1758, p. 613, no. 28) gave the name *Pediculus fulicæ* to Redi's plate, but without specifying any figure; the name is, therefore, composite. With the exception of Schrank, all pre-Nitzschian authors who mention

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* Possibly two species of *Rallicola*.

Pediculus fulicæ merely repeat the references without any attempt to restrict the name.

Schrank (1803, p. 191) describes a *Pediculus Fulicæ* from "Blasshuhn" (=Coot) and refers to "Redi, Opusc. I. Tab. IV. Fig. 3," *i. e.*, the Latin version of Redi. His description is very inadequate, but nothing in it conflicts with the species shown in Redi's plate. The description is not a formal restriction of Linné's name, because Schrank does not give any reference to the work of Linné. Harrison (1916, p. 14) adopts a procedure with regard to the name *Pediculus fulicæ* which is in accordance neither with the Rules of Nomenclature nor with common sense: he rejects *fulicæ* Linné as composite and *fulicæ* Schrank as invalidated by *fulicæ* Linné, although it is one of the components of the latter! But the Rules, fortunately, do not permit of the rejection of a name on the grounds that it is composite (if this were so we would have to reject an enormous number of the names at present in use for Mallophaga), but only of the restriction of such a name. I therefore formally restrict *Pediculus fulicæ* Linné, 1758, to fig. 3 of Redi's plate iv., thus making *Pediculus fulicæ* Schrank a synonym. The further synonymy will be dealt with below.

The *Pseudomenopon* was not known to Redi; it must have a brief mention because of a curious confusion over the host. It was first described by Burmeister (1838, p. 440) as *Menopon tridens*, the sole host being *Fulica atra*. Giebel added *Podiceps cristatus* to the list of hosts in 1866 (p. 396), and in 1874 (p. 296) gives a long list of hosts, including *Gallinula chloropus*. Piaget (1880, p. 479, pl. xxxix. fig. 1) first misidentified material from *Gallinula chloropus* as *tridens*, and then (on the next page) described specimens from *Fulica atra* as var. *major* (*nec M.* var. *major* Piaget, 1880, p. 441). Harrison (1916, p. 63) established the error yet deeper by giving the host of *tridens* as "*Gallinula chloropus*" and other Rails. Eichler (1937, p. 97), considering the forms on *Gallinula* and *Fulica* to be distinct, has been misled by the errors of Piaget and Harrison into proposing the name *Pseudomenopon thompsoni* as a *nomen novum* for the invalid *Pseudomenopon* var. *major* (Piaget). *P. thompsoni* Eichler is, of course, a synonym of *P. tridens*, and it is *tridens* Piaget, *nec* Burmeister, which requires renaming if the two forms are distinct, as is very probable.

In the brief list of Mallophaga published by Nitzsch in 1818 he mentions four species infesting the Coot: *Philopterus* (*Docophorus*) *pertusus* (p. 290), *Ph.* (*Nirmus*) *minutus* (p. 291), *Ph.* (*Lipeurus*) *luridus* (p. 292), and *Liotheum* (*Læmobothrion*) *atrum* (p. 302.)

The last-named need not detain us long. Nitzsch gives a reference to "Redi, Exp. t. iv. fig. 1"; the subgeneric definition fits the species there depicted, and the host is the same. Harrison (1916, pp. 63 and 65), wrongly considering *atrum* Nitzsch, 1818, to be a *nomen nudum*, replaced it by *nigrum* Burmeister, 1838. But the *Eulæmobothrion* of the Coot must stand as *E. atrum* (Nitzsch), 1818.

Philopterus (*Docophorus*) *pertusus* is a *nomen nudum* in so far as the 1818 paper is concerned, since all that Nitzsch says about it is "*Ph. pertusus* (*Fulicæ atræ*)."

In his mention of *P.* (*L.*) *luridus* (p. 292) Nitzsch gives a reference to Redi, pl. iv. fig. 2, and this figure fits his definition of the subgenus *Lipeurus* as constituted by him on the same page. But he gives the host as "*Fulicæ chloropod*," which is the Waterhen, *Gallinula c. chloropus* (Linné). Since it is by no means certain that the species of *Fulicoffula* found on the Coot and the Waterhen are the same, this point is of considerable importance. Assuming that the species found on these two hosts are different, *P.* (*L.*) *luridus* Nitzsch, 1818, is a mixture of a *nomen novum* for Redi's Pollino della Folaga and an undescribed species on the Waterhen. As an undescribed species cannot be taken into account, the name must be regarded as applying only to Redi's species. The type-host of *Fulicoffula lurida* (Nitzsch) is, therefore, the Coot, *Fulica a. atra*. Clay and Meinertzhagen (1938), misled by Harrison into considering *luridus* Nitzsch, 1818, to be a *nomen nudum*, have made *Esthiopterum luridum* (Denny) the genotype of *Fulicoffula*; fortunately Denny's species is also from the Coot, and is the same as that of Nitzsch.

We are left only with *Philopterus* (*Nirmus*) *minutus*, and this is much the most difficult case with which we must deal here. The reference is as follows :—

"*Ph. minutus* (*Fulicarum*). Redi, Experim. t. iv. fig. III."

Now Redi's pl. iv. fig. 3 is the *Incidifrons*, as already noted above, and some authors would contend that *minutus* Nitzsch should fall to *Incidifrons fulicæ* (Linné).

But both *pertusus* and *minutus* have been described from Nitzsch's material by later authors, in particular Giebel, who published Nitzsch's drawings of both species in 1874 (*pertusus* on pl. xi. figs. 3 & 12, and *minutus* on pl. v. fig. 7). The fact that these are Nitzsch's own drawings is of great importance, because it establishes beyond doubt that his *pertusus* is the *Incidifrons* and his *minutus* the *Rallicola*. This identification of the two names has been accepted by all later authors, and *pertusus* Nitzsch is the genotype of *Incidifrons* Ewing, 1929. Fortunately another circumstance proves conclusively that Nitzsch's reference to Redi under *minutus* is a *lapsus calami*: on the same page Nitzsch defines his subgenus *Nirmus*, the most important character from our present point of view being "Trabeculæ nullæ aut parvulæ, rigidæ." But Redi's pl. iv. fig. 3 shows an insect with very conspicuously large trabeculæ, and therefore grossly at variance with Nitzsch's definition of *Nirmus*. The discrepancy was noticed by Denny (1842, p. 125). On the other hand, Nitzsch's drawing of *minutus* (Giebel, 1874, pl. v. fig. 7) shows an insect with at most very small and rigid trabeculæ, thus conforming perfectly to the definition of *Nirmus*. I claim that *minutus* Nitzsch, 1818, should be regarded as a *nomen nudum*, the reference being a *lapsus calami* and referring to an insect which is at variance with Nitzsch's definition of the subgenus in which he includes it. This being so, the correct name of the species is *Rallicola fulicæ* (Denny), 1842 *.

In giving the synonymies of the principal species with which I have dealt here I have omitted many doubtful references or relegated them to notes. References to invalid names are enclosed in brackets.

Eulæmobothrion atrum (Nitzsch), 1818.

(Pollino della folaga, Redi, 1668, pl. iv. fig. 1.)
(The Louse of a Coot, Albin, 1736, pl. xliv. fig. [4].)
Liotheum (*Læmobothrion*) *atrum* Nitzsch, 1818, p. 302. *Nom. nov.* for Redi's pl. iv. fig. 1. On *Fulica atra*.
Læmobothrion nigrum Burmeister, 1838, p. 442. On *Fulica atra*.

There has never been any real confusion over this species, which was quite well figured by Giebel (1874, pl. xviii. fig. 5). Kellogg (1896, p. 155, pl. xiv. fig. 3) described and figured what is probably the same species, but from *Fulica americana*.

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* Even if my opinion on *minutus* is not accepted, the name of the species must still be as I have stated, because in that case *minutus* Nitzsch, 1818, is a synonym of *Incidifrons fulicæ* (Linné), 1758.

Incidifrons fulicæ (Linné), 1758.

(Pollino della folaga, Redi, 1668, pl. iv. fig. 3.)

Pediculus Fulicæ Linné, 1758, p. 613, no. 28. *Partim*; reference to Redi, pl. iv., but not to an individual figure. Restrict to Redi, pl. iv. fig. 3.

Pediculus Fulicæ Schrank, 1803, p. 191. On Blasshuhn.

(*Philopterus* (*Docophorus*) *pertusus* Nitzsch, 1818, p. 290. *Nomen nudum.*)

Docophorus pertusus Burmeister, 1838, p. 426. On *Fulica atra*.

Docophorus pertusus Nitzsch, Giebel, 1874, p. 108, pl. xi. figs. 3, 12. On *Fulica atra*.

Incidifrons pertusus (Nitzsch) Ewing, 1929, p. 190. Genotype of *Incidifrons*.

Rallicola fulicæ (Denny), 1842.

(*Philopterus* (*Nirmus*) *minutus* Nitzsch, 1818, p. 291. *Nomen nudum*, reference being a *lapsus calami* and indicating a species inconsistent with Nitzsch's definition of *Nirmus*. On *Fulicæ*.)

Nirmus fulicæ Denny, 1842, pp. 50, 125, pl. ix. fig. 2. On *Fulica atra*.

Nirmusminutus Nitzsch, Giebel, 1866, p. 375. On *Gallinula chloropus* and *Fulica atra*.

Nirmus minutus Nitzsch, Giebel, 1874, p. 170, pl. v. fig. 7. On same hosts.

It is particularly to be noted that, as has been pointed out by Bedford (1932, p. 342), "*Oncophorus minutus* N." of Piaget (1880, p. 215, pl. xviii. fig. 2) is not Nitzsch's species, though it may be seriously doubted whether it is *R. cuspidata* (Scopoli) as Bedford believed *. But there can be no reasonable doubt of the synonymy of *R. minuta* (Nitzsch) with *R. fulicæ* (Denny). The principal specific character given by Giebel in his description of the former (1866, p. 375) is that "bei dem Männchen das erste Fühlerglied fast so lang ist, wie die übrigen zusammen." In Denny's male type of *fulicæ* (examined by Mr. G. B. Thompson) this character is present. *Oncophorus advena* Kellogg, 1896 (p. 133, pl. xi. figs. 1 & 2), is also probably a synonym; it is from *Fulica americana*.

Fulicoffula lurida (Nitzsch), 1818.

(Pollino della folaga, Redi, 1668, pl. iv. fig. 2.)

Philopterus (*Lipeurus*) *luridus* Nitzsch, 1818, p. 292. *Nomen novum* for above.

Lipeurus luridus Nitzsch, Giebel, 1874, p. 230, pl. xvi. fig. 4. On *Gallinula chloropus* and *Fulica atra*.

Lipeurus luridus Nitzsch, Taschenberg, 1882, p. 140, pl. v. fig. 4. On *Fulica atra* and *Gallinula chloropus*.

Esthiopterum luridum (Denny), Clay and Meinertzhagen, 1938, p. 279. Genotype of *Fulicoffula*.

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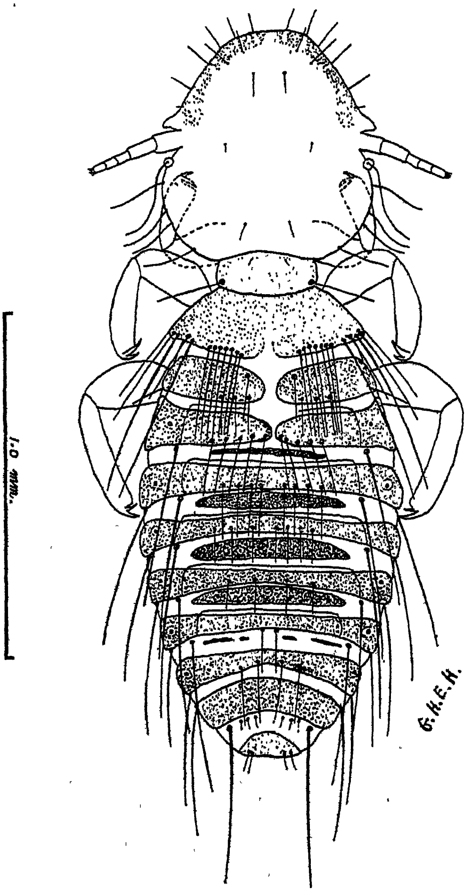
* Bedford was misled by Harrison into accepting *Fulica atra* as type-host of this species. It was described from *Rallus aquat*[*icus*].

From the American Coot Kellogg described a *Lipeurus longipilus* (1896, p. 119, pl. vii. fig. 7) and a *Lipeurus picturatus* (*loc. cit.*, p. 121, pl. viii. figs. 1 & 2). The former name is probably a synonym of *luridum*, and *picturatus* certainly applies to two immature stages of *longipilus*.

Fig. 1.



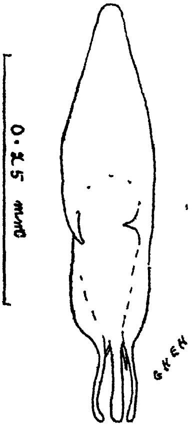
Otidœcus neotidis, sp. n., male.
Chætotaxy of antenna and legs omitted.

8. *A new Species of* Otidœcus.

The genus *Otidœcus* was erected by Bedford in 1931 (p. 285) for *O. dimorphus* Bedford, and has remained monotypical until now. The present species, which I name *Otidœcus neotidis*, is exceedingly close to *dimorphus*, and is best described by comparison with that species.

Male (fig. 1).—Head slightly longer than broad * (distinctly broader than long in *dimorphus*). Prothorax with only one pair of minute setæ anteriorly. The large group of setæ on the posterior margin of the pterothorax composed of only 7–9 setæ as against 9–11 in *dimorphus* (of which the types have been lent to me). First (apparent) abdominal tergite with only 3 setæ on each side on the median portion of the posterior margin, as against 5 in *dimorphus*. Third (apparent) tergite not broken in the median line. A vestigial accessory plate, in the form of narrow irregular strips of dark chitinization, behind the sixth tergite is also present in *dimorphus*, though much less marked, and omitted in Bedford's figure. Genitalia (fig. 2) of the same type as in *dimorphus*. In both species the tergocentral setæ are of a rather characteristic shape, broadest in the middle and tapering to both ends.

Fig. 2.



Otidœcus neotidis, sp. n., male. Genitalia.

Female with head almost exactly as broad as long (in *dimorphus* distinctly broader than long) ; chætotaxy of head and prothorax as in the male. Otherwise apparently inseparable from *dimorphus*.

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* The shape of the frontal region is not entirely accurate on the right-hand side of the figure ; it should be similar to the left-hand side.

The measurements, in millimetres, are as follows :—

	Male.		Fomale.	
	Length.	Width.	Length.	Width.
Head..............	0·62	0·60	0·73	0·71
Prothorax	0·13	0·30	0·14	0·37
Pterothorax	0·18	0·53	0·16	0·60
Abdomen	1·12	0·70	1·40	1·01
Total	2·05		2·43	

Holotype male, allotype female, and five male and ten female paratypes from *Neotis caffra jacksoni* Bannerman (Jackson's Rufous-necked Bustard), collected by Mr. T. W. Chorley near the River Unyama, Gulu District, Uganda, on 14th December, 1937.

Holotype and allotype in the British Museum ; paratypes in the Bedford, Carriker, Hopkins, and Meinertzhagen collections.

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XXXVIII.—*Notes on Species of the Genus* Pectinopygus (*s. l.*) (*Mallophaga*).—II. By GORDON B. THOMPSON.

Pectinopygus (*Philichthyophaga*) *nannopteri* (Ewing).

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Pectinopygus (*Philichthyophaga*) *nannopteri* (Ewing), Thompson, 1937, Ann. & Mag. Nat. Hist. ser. 10, vol. xx. p. 542.

Type-Host.—*Nannopterum harrisi* (Rothschild).

History of the Species :—

Ewing (1924) described and figured this species on the basis of a single female (and four nymphs) collected from *Nannopterum harrisi* (Rothschild), the Flightless Cormorant, at the Galapagos Is. The type (Cat. no. 23764, U.S.N.M.) is in the United States National Museum.

It seems that these specimens are the only recorded examples.

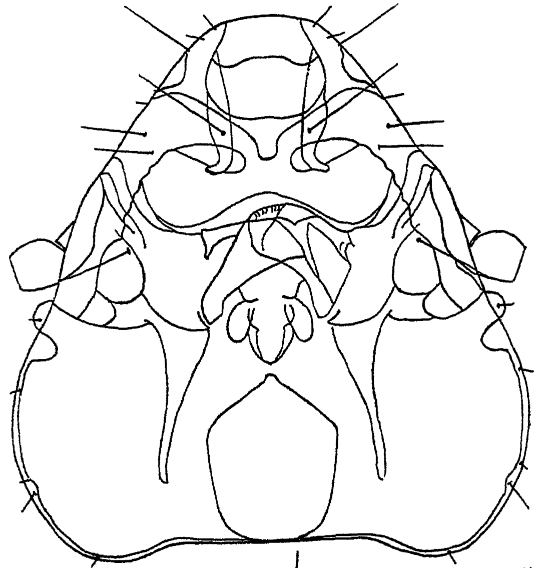
Notes :—

Having recently received a few males and females of a species of *Pectinopygus* collected off a Flightless Cormorant from the Galapagos Is., and bearing in mind the fact that the male has not yet been described, I am presenting the accompanying notes on the species. Unfortunately, I have not had one of my females compared with the unique type, but on comparing them with Ewing's description and figure, I have no hesitation in assigning my specimens to Ewing's species.

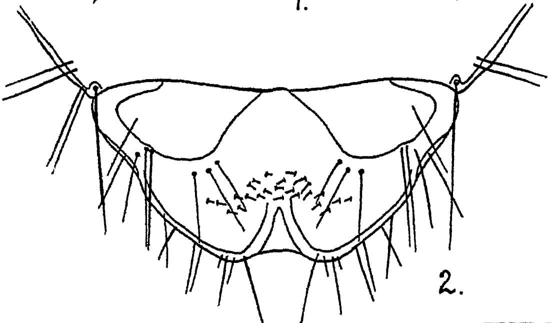
Specimens examined :—

6 ♀♀, 3 ♂♂; from *Nannopterum harrisi* (Rothschild), Galapagos Is.

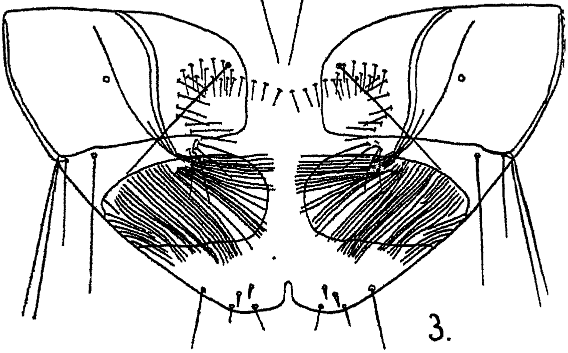
Since the male is as yet undescribed, I hereby designate one of my males as the allotype.



1.



2.



3.

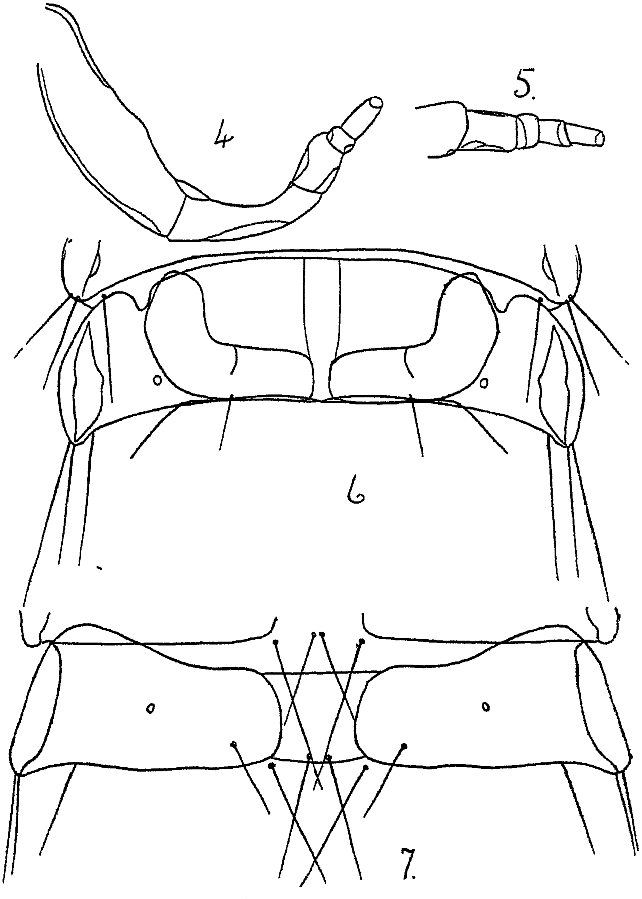
P. (*P.*) *nannopteri* (Ewing).

Fig. 1.—Head, ♀.
Fig. 2.—Terminal abdominal segments, ♂.
Fig. 3.—Terminal abdominal segments, ♀.

Brief description.—A moderately robust, fairly heavily sclerotised and pigmented form.

Female (figs. 1, 3, 5, 7).

Length.—2·4 mm. *Greatest breadth.*—0·8 mm.



P. (*P.*) *nannopteri* (Ewing).

Fig. 4.—Outline drawing of antenna, ♂.
Fig. 5.—Outline drawing of antenna, ♀.
Fig. 6.—4th abdominal segment, ♂.
Fig. 7.—4th abdominal segment, ♀.

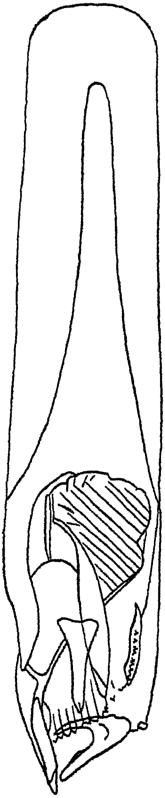
Ewing's description is sufficient to enable me to dispense with this sex except for reference to figs. 1, 3, 5 and 7.

Male (figs. 2, 4, 6, 8).

Length.—2·6 mm. *Greatest breadth* —0·7 mm.

A slightly longer but narrower form closely resembling the female in general characters. The antennæ differ very markedly (see fig. 4). The abdominal segments differ, as shown in figs. 6 and 7. The terminal abdominal segments and the genitalia are very distinctive (see figs. 2 and 8).

Fig. 8.



P. (*P.*) *nannopteri* (Ewing).
♂ genitalia.

With the addition of the male to our knowledge of this species I have no hesitation in placing it in the subgenus *Philichthyophaga*, along with those species occurring on other members of the genus *Phalacrocorax* (Cormorants).

XXXIX.—Scolytidæ *and* Platypodidæ.—61. *Contribution.*

By Karl E. Schedl.

The collections which were made by Miss L. E. Cheesman in New Guinea in 1933–34 and 1936–37 have been sent to me for identification by Mr. Gilbert J. Arrow of the British Museum. I have already described some of the new species, and descriptions of others follow below.

I have assembled the known species in two lists. The distribution in regard to altitude is quite interesting. Disregarding such factors as the length of collecting time, weather, etc., the greatest number of species is found at an altitude of 1200 ft. This is true for Dutch New Guinea as well as for the British part of the island. Barkbeetles are also fairly well represented at heights of 930 and 2000 ft. on the Cyclops Mts. At the higher levels the number of species decreases rapidly. In Papua, however, barkbeetles appear to be abundant at distinctly higher levels.

Among the species represented *Platypus jansoni* Chap. shows the widest range of altitude distribution, from 1200 ft. to 8500 ft. Next to it follow *Ozopemon angustæ* Egg., *Platypus chevrolati* Chap., and *Xyleborus testaceus* Walk. The majority of the species have been found in both parts of the island, a fact which is probably connected with the technique of collecting.

Notes and new Species.

Platypus pallidus Chap.

The specimens from Papua: Kokoda, 1200 ft., are smaller, 2·7 mm. long, than those from other localities I have seen. The apical sutural emargination is narrower, comparatively shorter, the outer emargination distinctly larger. On account of the wide variations which occur in this group of the family I cannot regard this as more than a local variety, and I call it *Platypus pallidus* var. *sabroni* nov.

Hylesinus nanulus, sp. n.

Ferrugineous, 1·7 mm. long, 2·0 times as long as wide, readily distinguished from the allied small species of the genus by the very narrow interstices of the elytra.

TABLE I.—Species collected in various localities and altitudes in Papua in the mountains to the north of Port Moresby. [Kokoda: 8° 55′ S., 147° 40′ E., about 55 miles N.E. of Port Moresby. Mafulu: 8° 30′ S., 147° E.]

	Huon Golf, Morobe District, 1937 (*Froggatt*).	Papua: Kokoda, 1933. 1200′	Papua: Kokoda, 1933. 1300′	Papua: Ishurava, 1933. 3000′	Papua: Mafulu, 1933. 4000′	Papua: Oquali, 1934. 4000′	Papua: Mondo, 1934. 5000′	Papua: Mt. Tafa, 1934. 8500′
Crossotarsus mniszechi Chap.	..	×						
„ *barbatus* Chap.	..	×						
„ *majusculus* Samps.	..	×						
„ *kokodaensis* Schedl	..	×						
„ *cheesmani* Schedl	..	..	..	..	..	..	..	×
„ *kuntzeni* Schedl	×							
Platypus chevrolati Chap.	..	×	×	..	×	×	×	
„ *lepidus* Chap.	..	×	..	..	×	×	×	
„ *pallidus* Chap.	..	×						
„ *jansoni* Chap.	..	×	×	..	..	..	..	×
„ *lucasi* Chap.	..	×						
„ *seleysi* Chap.	..	×						
„ *emdeni* Schedl	..	..	..	×				
Spathidicerus papuanus Schedl	..	×						
Dactylopalpus transversus Chap.	..	..	×					
Hylesinus nanus Schedl	..	×						
Negritus ater Egg.	..	×						
Stephanoderes alter Egg.	..	×						
Ozopemon angustæ Egg.	..	..	×					
Dryocœtes rotundicollis Egg.	..	×						
Pelicerus affinis Schedl	..	×						
„ *philippinensis* Egg.	..	×						
„ *nitidus* var. *orientalis* Egg.	..	×						
Xyleborus ursa Egg.	..	..	..	..	..	..	..	×
„ *punctatopilosus* Schedl	..	..	..	..	×			
„ *canaliculatus* Egg.	..	..	..	..	×			
„ *wallacei* Blandf.	..	×						
„ *præustus* Egg.	..	×						
„ *testaceus* Walk.	..	×	..	..	..	..	×	
Eccoptopterus collaris Egg.	..	..	..	×	×			
„ *sexspinosus* Motsch.	×	×	..	..	×			
Xyleboricus morio Egg.	..	..	..	..	×			

Table II.—Species collected in various localities and altitudes in Dutch New Guinea.

	Humboldt Bay Distr., Bewani Mts., 1937.	Lake Sentani, Iffar, 1936.	Kjau-Limon, S. of Mt. Bougainville, 300′, 1936.	Mt. Nomo, S. of Mt. Bougainville, 700′, 1936.	Cyclops Mts., Sabron.					
					930′	1200′	2000′	3500′	3500′ to 4500′	* Mt. Lima, 4500′
Crossotarsus mniszechi Chap.	..	..	..	×	..	×				
,, *barbatus* Chap.	..	..	..	×	×	×				
,, *kuntzeni* Schedl	..	..	..	..	×	×	×			
,, *majusculus* Samps.	×	..	..	..	..	×	×			
Platypus jansoni Chap.	..	..	..	..	..	×				
,, *lucasi* Chap.	..	..	..	..	..	..	..	×		
,, *seleysi* Chap.	..	..	..	..	..	×				
,, *crassus* Strohm.	..	..	..	..	..	..	..	×		
,, *chevrolati* Chap.	..	..	..	..	×	×	×			
,, *schultzei* Strohm.	..	..	..	..	×	×				
,, *pallidus* v. *sabroni*	..	..	..	..	×	×				
Dactylopalpus transversus Chap.	..	..	..	..	..	×				
Neoxyloctonus pusillus Egg.	..	..	..	..	..	×				
Ericryphalus securus Schedl	..	..	..	..	..	×				
,, *tetricus* Schedl	..	..	..	..	..	×	×			
Ozopemon angustæ Egg.	..	×	..	..	×	..	×	×	×	
,, *grossepunctatus* Egg.	..	..	..	..	..	..	..	×		
,, *cylindricus* Egg.	..	..	..	..	..	..	..	..	..	×
,, *papuanus* Egg.	..	..	..	×						
Pelicerus pygmæus Egg.	..	..	..	×	×	×				
,, *philippinensis* Egg.	..	..	..	×	×	×				
,, *cyclopus* Schedl	..	..	..	..	×	..	×			
,, *nitidus* Egg. var. *orientalis* Egg.	..	..	..	×	×	×				
,, *minor* var. *robustus* Schedl	..	..	..	×	×					
Xyleborus fallax Eichh.	..	..	..	..	..	×				
,, *fastigatus* Schedl	..	..	..	..	×					
,, *emarginatus* Eichh.	..	..	..	..	..	..	×			
,, *puer* Egg.	..	..	..	..	..	..	..	×		
,, *cyclopus* Schedl	..	..	..	..	..	..	..	..	×	
,, *præustus* Egg.	..	..	..	..	×					
,, *testaceus* Walk.	..	..	..	×	×	×	×			
,, *sordicauda* Motsch.	..	..	..	×						
,, *semigranosus* Blandf.	..	..	..	×						
,, *banjoewangi* Schedl	..	..	×							
,, *bituberculatus* Egg.	..	..	..	..	..	×				

Front convex, densely granulate-punctate, eyes very large.

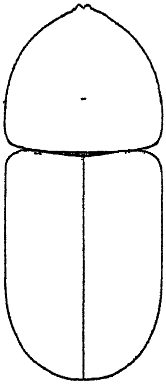
Pronotum much wider than long (40 : 27), with a transverse depression behind the feebly emarginate front margin, opaque, densely areolate-punctate, with a few minute asperities in the antero-lateral corners. Scutellum very small.

Elytra wider (47 : 40) and more than twice as long as the pronotum, the striæ deep, the strial punctures quadrate, nearly touching each other, interstices distinctly narrower than the striæ, carinate, uniseriately granulate, each with a row of very short inclined yellow hairs, the entire elytra with few scattered slender hair-like scales.

Holotype in the British Museum of Natural History; paratype in my collection.

Locality.—Papua : Kokoda, 1200 ft., vii. 1933 (*L. E. Cheesman*).

Fig. 1.



Ericryphalus securus, sp. n. Outline.

Ericryphalus securus, sp. n.

Brown, 1·1 mm. long, 2·4 times as long as wide; remarkable through the coarse spatulate scales on the elytral declivity.

Front shining, plano-convex, rather narrow, the eyes approximate to beyond the width of the mouth.

Pronotum with the outline as shown in fig. 1, postero-lateral angles rectangular but hardly rounded, summit far behind the middle, rather high, obliquely declivous in front, asperities moderate in size, restricted to the anterior margin and a transverse patch before the summit, between these two series, on the sides and on the posterior area minutely punctulate, pubescence very short but quite dense.

Elytra feebly wider and 1·7 times as long as the pronotum, sides parallel on the basal half, broadly rounded behind, declivity commencing short behind the middle, rather steeply and evenly convex; base finely and distinctly carinate, scutellum not visible, disc irregularly and very densely punctured, without any recognizable striæ, each puncture bearing a minute, extremely short inclined hair, the interstices between the punctures narrower than the diameter of these; the declivity with rows of rather large, stout, remotely placed, erect and spatulate yellow scales, indicating the interspacial rows, the ground vestiture but little more distinct than on the disc.

Holotype and paratype in the British Museum of Natural History; paratype in my collection.

Locality.—Dutch New Guinea, Cyclops Mts., Sabron, Camp 1, 1200 ft., 15. v. 1936 (*L. E. Cheesman*).

Ericryphalus tetricus, sp. n.

Testaceous, 1·2 mm. long, twice as long as wide.

Front plano-convex, densely punctulate, the eyes remote.

Pronotum wider than long (32 : 21), widest at the base, outline semicircular, with a slight anterior constriction and with six low and small serrations, summit high and distinctly behind the middle, anterior area steeply declivous, with a rather large patch of small asperities, sides and basal area very densely punctulate, base finely margined, pubescence fine and erect. Scutellum small and distinct.

Elytra but feebly wider and more than twice as long as the pronotum, sides parallel up to the middle, broadly rounded behind, declivity commencing halfway, long, uniformly convex; disc very densely and irregularly punctured, each puncture bearing a minute short and yellow hair, interspaces indicated by rows of longer, erect but fine hairs, these hairs becoming somewhat scale-like and the ground vestiture more distinct on the declivity, especially on the upper half of the convexity.

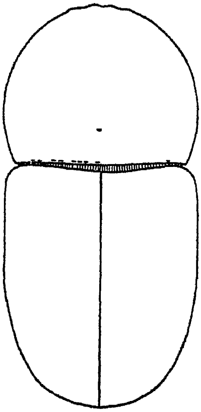
Holotype in the British Museum of Natural History; paratypes in my collection.

Locality.—Dutch New Guinea, Cyclops Mts., Sabron, Camp 1, 1200 ft., 15. v. & vi. 1936 (*L. E. Cheesman*).

Pelicerus pygmæus Egg.

In the long series before me I find some sexual differences. Some specimens are comparatively larger, more slender, and have the front transversely depressed below; in the upper half there is also a low circular elevation. The other specimens, probably the males, are stouter, smaller, and with the front simply plano-convex. The great number of specimens and the remark on some of them "on cotton" seems to indicate that this species is connected in some way with the cultivation of this plant.

Fig. 2.



Ericryphalus tetricus, sp. n. Outline.

Pelicerus minor var. *robustus* nov.

Larger than the *P. minor* Egg., 1·5–1·7 mm. long, the punctuation decidedly coarser, especially on the pronotum and the elytral disc, the declivity more abruptly convex, the granules of the interspaces coarser, the striæ much deeper. In the long series before me these specimens are conspicuous.

Holotype and paratypes in the British Museum of Natural History ; paratypes in my collection.

Locality.—Dutch New Guinea, Cyclops Mts., Sabron, Camp 1, 1200 ft., v.–vi. 1936 (*L. E. Cheesman*).

Pelicerus affinis, sp. n.

Reddish brown, 2·0 mm. long, from 1·6–2·0 mm., 2·4 times as long as wide. Stouter than any other species of the genus, the pronotum narrowly rounded in front, elytral disc with the striæ strongly impressed, declivity evenly rounded.

Front plano-convex, opaque on a subcircular area, with sparse and long pubescence, eyes very large, with few punctures towards the vertex.

Pronotum feebly longer than wide, base transverse, postero-lateral angles rounded, sides subparallel on the basal third, thence obliquely and rather strongly narrowed, apex narrowly rounded, summit at the middle, anterior area very finely and densely asperate, posteriorly rather coarsely punctured. Scutellum of medium size and shining.

Elytra but feebly wider and 1·3 times as long as the pronotum, sides parallel on the basal three-fifths, broadly rounded behind, declivity commencing shortly behind the middle, evenly convex ; disc striate-punctate, first striæ deeply, the others gradually less impressed, the punctures rather small and closely placed, a row of very fine punctures on the interstices ; declivity with the strial punctures smaller, those of the interstices obsolete, the first and the third interstices with a few fine setose granules.

Holotype and paratypes in the British Museum of Natural History ; paratypes in my collection.

Locality.—Papua : Kokoda, 1200 ft., viii. 1933 (*L. E. Cheesman*) ; Dutch New Guinea, Cyclops Mts., Camp 1, 1200 ft., vi. 1936 (*L. E. Cheesman*).

Pelicerus cyclopus, sp. n.

Reddish brown, 2·7 mm. long, 2·7 times as long as wide. The largest species of the genus, very cylindrical and coarsely sculptured.

Front plano-convex, aplanate on a semicircular area, very densely and very finely punctured, with pale yellowish pubescence, the hairs of the central portion shorter than those of the upper border and the sides. Eyes as usual rather large.

Pronotum longer than wide (57 : 51), base transverse, postero-lateral angles feebly and shortly rounded, sides parallel on the basal half, strongly narrowed in front, apex moderately narrowly rounded, summit in the middle, anterior area uniformly and rather feebly convex, the entire surface roughly and densely punctured, more finely so and somewhat more granulate in front, the punctures coarse and deep behind; pubescence on the whole beetle sparse, rather long and fine. Scutellum subquadrate and shining.

Elytra but little wider and 1·5 times as long as the pronotum, parallel-sided and cylindrical on the basal two-thirds, broadly rounded behind, declivity rather steeply convex; disc very coarsely striate-punctate, punctures very large, closely placed, and therefore reducing the first two interstices to irregular fine lines on which minute punctures are visible, the other interstices feebly wider, the rows of fine punctures more distinct; on the declivity the strial punctures become smaller, those of the second interstice larger, on the alternate first and third interstices the punctures replaced by several small granules. The entire declivity of a rough appearance caused by the extremely narrow interstices compared with the size of the strial punctures.

A second specimen, with the front simply convex and with sparse, inconspicuous pubescence and moderately large punctures, I believe represents the other sex, apparently the male.

Holotype and paratypes in the British Museum of Natural History; paratypes in my collection.

Locality.—Dutch New Guinea, Cyclops Mts., Sabron, Camp 2, 2000 ft., vii. 1936; same locality, 930 ft., vi. 1936 (*L. E. Cheesman*).

Xyleborus cyclopus, sp. n.

Three females before me have exactly the same general shape and declivital armature as *Xyleborus amphicran-*

oides Hag. and *X. fischeri*, but show the following differences :—

Smaller, 4·3 mm. long (*amphicranoides*, 5·0–5·3 mm.), more slender, 3·8 times as long as wide (*X. fischeri*, 3·3 times), front more coarsely granulate-punctate, pronotum much more slender, with the summit in the anterior third (*X. fischeri* behind the middle); the asperities of the anterior area are coarser and more remotely placed, the posterior area shining and regularly punctate. Elytra more slender again, declivity commencing farther behind, sutural emargination in spite of the smaller size of the beetles larger and deeper, the lateral processes therefore longer, the sutural tooth similar as in *X. amphicranoides*, the second tooth much longer and very slender, the cavity not heart-shaped but perfectly oval above and the subapical granules and the lateral process larger.

Holotype and paratype in the British Museum of Natural History ; paratypes in my collection.

Locality.—Dutch New Guinea, Cyclops Mts., Mt. Lina, 3500–4500 ft., iii. 1936 (*L. E. Cheesman*).

Xyleborus rameus, sp. n.

Of the same general shape and colour as *Xyleborus lævis* Egg., but with the interstices alternating on the declivity ; 2·2–2·3 mm. long, 2·9 times as long as wide.

Front plano-convex, shining, with a few coarse punctures near the epistomal margin and the sides.

Pronotum longer than wide (45 : 42), postero-lateral angles broadly rounded, sides subparallel, feebly arcuate on more than the basal half, moderately broadly rounded in front, summit in the middle, anterior area finely and densely asperate, shining and with minute sparse punctuation behind. Scutellum triangular.

Elytra as wide and 1·6 times as long as the pronotum, the outline as in *X. lævis* Egg., the apical sutural notch somewhat larger, the dorsal line more strongly convex when viewed from the sides, the declivity longer and more oblique, somewhat aplanate ; disc lineate-punctate, interstices with a row of very much smaller and more remotely placed punctures, declivity with the striæ 2, 3, 4 impressed, the first on the upper half only, first interstice widened below, with 2–3 fine tubercles, the lowest larger than the others and similar as in the *X. similis* Ferr. group, the second interstice narrow, the third elevated again but with the tubercles minute.

Types in my collection and most probably in the collection of Mr. F. C. Hadden, Honolulu.

Locality.—Mt. Makiling, Laguna, Luzon, 26. viii. 1930, 29. vii. 1932, ex *Sideroxylon macranthum* F. C. Hadden.

The new species has hitherto been associated with *X. lævis* Egg. from the same locality and host. Two specimens from the Fiji Is., Nadavivalu, vii. 1938 (*A. Smith*), are somewhat larger, 2·3 mm. long, and have the elytral declivity more steeply convex.

Eccoptopterus (*Xyleborus*) *collaris* Egg.

One specimen from Java in my collection shows the bright colour mentioned by Eggers; other specimens, a good series from the Philippines and now from New Guinea, are rather large, 3·5–4·2 mm. long, but have the same arrangement of the teeth as typical for the species. Irregularities, even in one and the same specimen, on the two wing-covers are common for the group; the colour of the type might be accidental, not fully mature. *Eccopterus gracilipes* seems to be an intermediate form between *E. collaris* Egg. on the one and *E. sexspinosus* Motsch. on the other hand.

XL.—*Notes on some Types of* Chrysopidæ (*Neuroptera*) *in the British Museum Collections*. By D. E. KIMMINS, Department of Entomology, British Museum (Natural History).

THE acquisition recently of the McLachlan collection and of the Tillyard collection of Neuroptera has added considerably to the number of types in the British Museum collections. It was the practice of McLachlan, as with many other workers, when describing a species from more than one specimen, to mark as "types" (=co-types) all of the series before him; and the primary object of these notes is to select from his series in such cases a single specimen and designate it as type. I have endeavoured to perform a similar service also for the Walkerian and certain other types of Chrysopidæ.

The second purpose of this paper is to place on record various instances of synonymy that I have established at various times, and also to publish one or two new names for certain species whose names are preoccupied. I have not attempted to correct a number of cases of homonymy for which Navás is responsible, as I feel certain that many of them will be found to be either synonyms or else to have been described subsequently under names which would be available.

Synthochrysa lutea (Walker).

Chrysopa lutea Walker, 1853, List Neur. Ins. B.M. ii. p. 272.
Apochrysa lutea (Walker) McLachlan, 1867, J. Linn. Soc. ix. p. 270.
Oligochrysa gracilis Esben-Petersen, 1914, P. Linn. Soc. N.S.W. xxxix. p. 639, **syn. nov.**

Walker's type bears only "Australia" as a locality label, but from the McLachlan collection there is an example labelled "Sydney, N.S.W." Another example in the British Museum is from Moreton Bay, and from the Tillyard collection we have a series (including Esben-Petersen's type) from Brisbane, Toowoomba, and Bulimba, taken in the months of May, June, August, November, and December.

NOBILINUS Navás, 1913.

Ann. Soc. sc. Brux., Mém. xxxvii. p. 295.

I think the separation of this genus from *Synthochrysa* Needham is justified by the different disposition of the inner gradate series, as indicated by Banks (1931, J. F. M. S. Mus. xvi. p. 383). The genotype, *N. insignitus* Navás from Palawan, is very similar to *Nobilinus aurifera* (Walker) and possibly synonymous. Both species have brown meso- and metanota, whilst in *N. phantoma* these areas are pale.

Nobilinus aurifera (Walker).

Chrysopa aurifera Walker, 1853, List Neur. Ins. B.M. ii. p. 272.
Apochrysa aurifera (Walk.) McLachlan, 1863, J. Ent. ii. p. 114 (footnote).
Nobilinus aurifera (Walk.) Banks, 1931, J. F. M. S. Mus. xvi. p. 383.

From the two examples mentioned by Walker I select as *type* the specimen bearing a round, pale blue label, "Ceylon," 52.62, and a label with the name "*aurifera*" in manuscript. This is the Walkerian specimen "*a*," and is in very good condition, the wings not expanded.

Specimen "*b*" is in poor condition, one posterior wing now missing and the other incomplete.

Domenechus mirifica (Gerstaecker).

Apochrysa mirifica Gerstaecker, 1888, M. T. Vorpomm. xix. p. 122.
Domenechus sigillatus Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxvii. p. 299, **syn. nov.**

Navás' type (from Guatemala) agrees perfectly with an example determined by McLachlan from Chiriqui.

Lainius constellatus Navás.

Lainius constellatus Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxvii. p. 300.

Navás had before him three examples from a series of nine, all from Guatemala, Cerro Zunil, 4000 feet (*Champion*).

Two now bear his determination and "Typus" labels, and of these I propose as *type* the one with a distinct brown spot in the basal third of the anterior wing, as shown in his fig. 6, p. 301.

Leucochrysa clara (McLachlan).

Chrysopa clara McLachlan, 1867, J. Linn. Soc. ix., Zool. p. 254.
Allochrysa clara (McL.), Navás, 1913, Brotéria, Zool. xi. p. 159.
Allochrysa scioptera Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxvii. p. 315, **syn. nov.**

Leucochrysa internata (Walker).

Chrysopa internata Walker, 1853, List. Neur. Ins. B.M., ii. p. 252.
Leucochrysa internata (Walk.), Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxvii. p. 303.
Nodita internata (Walk.), Navás, 1917, Ent. Mitt. vi. p. 280.
Chrysopa ampla Walker, 1853, List. Neur. ii. p. 268.

Of the two Walkerian co-types of *internata* I select as *type* the example without locality carrying a MSS. label "*internata.*" The other example is Walker's var. *β*. In the case of *ampla*, I also select as *type* the example without locality labelled "*ampla*" the other specimen being the var. *β* from Georgia. *C. ampla* was placed in the synonymy of *C. internata* by McLachlan in 1867.

Leucochrysa nigriceps (McLachlan).

Chrysopa nigriceps McLachlan, 1867, J. Linn. Soc. ix., Zool. p. 251.
Leucochrysa nigriceps (McL.) Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxvii. p. 303.
Nodita nigriceps (McL.) Navás, 1917, Ent. Mitt. vi. p. 280.

This species was incorrectly placed by Navás in *Nodita*, the form of the intramedian cell in the fore wing being typical of *Leucochrysa* McL.

Nodita navasi, **nom. nov.**

Leucochrysa alternata Navás, 1914, Ann. Soc. sci. Brux., Mém. xxxviii. p. 109 (**Mexico**).
Nodita alternata (Navás), 1917, Ent. Mitt. vi. p. 280.
Nec *Leucochrysa alternata* Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxvii. p. 305 (**Costa Rica**).

Suarius nana (McLachlan).

Chrysopa nana McLachlan, 1893, Tr. Ent. Soc. Lond. 1893, p. 230.
Chrysopa pretiosa Gerstaecker, 1893, MT. Ver. Vorpomm. xxv. p. 158
Chrysopa nymphula Navás, 1910, Rev. Ac. Madr. ix. p. 475.
Suarius walsinghami Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxviii. p. 73, **syn. nov.**
Chrysopa nymphulina Navás, 1915, Bull. Soc. ent. Egypte, vi. p. 154.

From the four examples originally mentioned by McLachlan (all females) I select as *type* the specimen with the red-edged locality label. It is one of three from Adana, Asia Minor.

Suarius walsinghami Navás is a male (with a slightly aberrant venation) of *S. nana* (McL.), the latter being described from the female sex, but there are subsequent examples of both sexes from Algeria in the McLachlan collection. The thickened radius of both wings is a noticeable feature of the male, and in the posterior wing this vein is covered with thickened scale-like hairs.

Chrysopa antica Walker.

1853, List. Neur. Ins. B.M. ii. p. 270.
Chrysopa regina Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxviii. p. 84, **syn. nov.**

From the two Walkerian specimens I select as *type* that bearing his label "*antica*" and a round label with the numbers 38.11.8.177.

Navás' type of *regina* is a pale form of *C. antica* with the dark cross-veins at the base of the costal and in the radial areas very indefinite. *Chrysopa vuilleti* Navás, 1914, is probably also a synonym of *C. antica* Walk.

Chrysopa atlantica McLachlan.

1882, J. Linn. Soc. Lond. xvi. p. 167.

I select as *type* the female from Madeira presented to McLachlan by Wollaston.

Chrysopa caviceps McLachlan.

1898. Trans. Ent. Soc. Lond. p. 165.

From the eight examples taken by Monsieur L. Bleuse at Aïn Séfra in South Oran, and regarded by McLachlan as typical, I select as *type* a male.

Chrysopa cognata McLachlan.

1867, J. Linn. Soc. Lond. ix., Zool. p. 249.

The type-series consists of seven examples, five from China and one each from Japan and Cambodia. I have selected the latter specimen as *type.*

Chrysopa conformis Walker.

1853, List Neur. Ins. B.M. ii. p. 269.

This name is preoccupied by *Chrysopa conformis* (Rambur), 1842, Hist. Nat. Ins. Nevr. p. 426.

Rambur's species was originally described in the genus *Hemerobius* Rambur, nec L., and was transferred to *Chrysopa* by Walker himself in 1853. I can trace no record of the re-naming of Walker's species, and therefore propose for it the name **Chrysopa gossei**, nom. nov., in honour of the collector of the unique *type.*

Chrysopa dasyphlebia McLachlan.

1894, Ann. Mag. Nat. Hist. (6) xiii. p. 425.

Fifteen examples in the McLachlan collection bear his type-label, and there are eleven others from the same locality, Ta-chien-lu. The latter are, I believe, of a different date, as the locality- and determination-labels differ in size and handwriting from those with type-labels. Probably the two missing types were presented to other neuropterists. I have selected as *type* a male.

Chrysopa exul McLachlan.

Chrysopa exul McLachlan, 1869, Ent. Mon. Mag. vi. p. 23.
Chrysopa wollastoni Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxviii. p. 80, **syn. nov.**

Both types are from St. Helena.

Chrysopa fortunata McLachlan.

1882, J. Linn. Soc. Lond. xvi. p. 164.

I select as *type* the more complete of the two females in the type-series, the other lacking both antennæ.

Chrysopa interrupta Schneider.

1851, Symb. Mon. Gen. Chrysop. p. 76.
Chrysopa attenuata Walker, 1853, List. Neur. Ins. B.M. ii. p. 242, **syn. nov.**

The above synonymy was pointed out to me by Professor R. C. Smith, of Kansas, during his visit to the British Museum in 1936. From Walker's two examples I select as *type* that bearing his label and Professor Smith's label identifying it with *interrupta* of Schneider.

Chrysopa intima McLachlan.

Trans. Ent. Soc. Lond. 1893, p. 230.

I select as *type* a male from Amurland, Pokrofska, 29. viii. There remain as paratypes a female and a defective specimen from the same locality, a male and female from Irkoutsk, and two females from Japan.

Chrysopa microphya McLachlan.

1883, Ann. Mag. Nat. Hist. (5) xii. p. 300.

I select as *type* the male, bearing the label " 22 Body and veins bright green."

Chrysopa mutata McLachlan.

1898, Tr. Ent. Soc. Lond. p. 167.

From the five co-types I have selected as *type* the first in McLachlan's series, a male from Biskra, 30. iii. 1895.

Chrysopa nigrovaria Walker.

Chrysopa nigrovaria Walker, 1853, List Neur. Ins. B.M. ii. p. 253 ; McLachlan, 1867, J. Linn. Soc. ix., Zool. p. 269.
Leucochrysa nigrovaria (Walker) Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxvii. p. 303.
Nodita nigrovaria (Walker) Navás, 1917, Ent. Mitt. vi. p. 280.

McLachlan rightly points out that the *type* of *nigrovaria* and its var. β are two very different species. From what remains of the type I think that its original placing in *Chrysopa* was more correct, having regard to the shape of the intramedian cell.

Chrysopa punctilabris McLachlan.

1894, Ann. Mag. Nat. Hist. (6), xiii. p. 426.

The four co-types and three subsequent specimens are present. I have selected one of the two males in the original series as *type*.

Chrysopa remota Walker.

1853, List. Neur. Ins. B.M. ii. p. 238.

One of the two types from Navigator's Islands is now missing from the collection; the other, bearing the label "*remota*," I designate as *type*. Neither the type nor the paratype from Loochoo Islands now possesses an abdomen.

Chrysopa oceanica Walker is very closely related to this species and may possibly be a synonym, as has been suggested by Hagen.

Chrysopa subcostalis McLachlan.

1882, J. Linn. Soc. Lond. xvi. p. 166.

From the five females listed by McLachlan I select as *type* the specimen dated 15. xii. 1880, collected at Orotava.

Chrysopa transversa Walker.

1853, List. Neur. Ins. B.M. ii. p. 255.

Walker lists three examples; of these one differs considerably from the others in the form of the costal area, the presence of a black stripe on the basal segment of the antenna, and in having black markings on the face. I am not sufficiently acquainted with the Jamaican Chrysopidæ to say to which species this example belongs.

Of the remaining two I have labelled as *type* a male, the other lacking its abdomen.

Chrysopa walkeri McLachlan.

Trans. Ent. Soc. Lond. 1893, p. 229.

There are two specimens bearing McLachlan's determination and type-labels (the examples from Mehadia in Hungary sent by Dr. Brauer). From these I select as *type* the expanded example with the label "*C. walkeri* Brau." in Brauer's handwriting. There is a long series from the Pyrénées Orientales with blue locality-labels, which may be considered as paratypes.

Meleoma dolicharthra (Navás).

Chrysopa dolicharthra Navás, 1913, Ann. Soc. sc. Brux., Mém. xxxviii. p. 96.

It is difficult to understand how Navás could have overlooked the definite interantennal horn and excavate face in this species (which are the generic characters of *Meleoma*) whilst remarking on the unusually long basal segments of the antennæ.

Eremochrysa punctinervis (McLachlan).

Chrysopa punctinervis McLachlan, 1869, Ent. Mon. Mag. vi. p. 24.
Eremochrysa punctinervis (McL.) Banks, 1903, Tr. Am. Ent. Soc. xxix. p. 159.

I have selected as *type* the female having the wings expanded. Subsequent to the two examples of the type-series from Texas there are numerous examples in the McLachlan collection from Arizona.

GLENOCHRYSA Esben-Petersen, 1920.

I think the following species should be transferred to *Glenochrysa* :—

Chrysopa conradina Navás, 1910 ; *Eremochrysa marmorata* Needham, 1909 ; *Chrysopa zeylanica* Banks, 1913.

Anomalochrysa hepatica McLachlan.

1883, Ann. Mag. Nat. Hist. (5) xii. p. 299.

From the pair in the McLachlan collection I have selected as *type* the male.

Anomalochrysa rufescens McLachlan.

1883, Ann. Mag. Nat. Hist. (5) xii. p. 300.

I select as *type* the male, mounted on a card bearing the number 20 on its lower surface.

XLI.—*The Genus* Stilbopteryx *Newman* (*Neuroptera*).

By D. E. KIMMINS, Department of Entomology, British Museum (Natural History).

THIS interesting Australian genus has had a rather troubled history, having affinities with both the Myrmeleonidæ and Ascalaphidæ. Newman himself placed it in his natural order Myrmeleonites. Lefèbvre, in 1842, under the name *Azesia*, placed it definitely in the Ascalaphidæ. Hagen, 1866, transferred it to the Myrmeleonidæ, and in 1870 McLachlan omitted the genus from his classification of the Ascalaphidæ on the grounds of the short antennæ, "believing, nevertheless, that the discovery of the earlier stages will reinstate it in its original position." By this I take him to mean Ascalaphidæ, as in a footnote he says: "... I have discovered a character which tends to prove that *Stilbopteryx* has really more relationship to the Myrmelionidæ than to the Ascalaphidæ. At the extreme base of the inner margin of the posterior wings of the male is a corneous semipedunculate knob. This is present in the males of *Palpares*, *Acanthaclisis*, etc., but, I think, is always absent in Ascalaphidæ."

Weele, in his 'Monograph of the Ascalaphidæ,' 1908, included *Stilbopteryx*, but Tillyard was of the opinion that it belonged to a separate subfamily of the Myrmeleonidæ related to, but distinct from, the Palparinæ. This is the course which I have finally adopted, based chiefly on the presence of the small clavate process at the base of the posterior wings of the males.

I have so far recognized five species, but I think it probable that this number will be increased. Some distinctions can be found in the form of the tenth sternite and its appendages in the male, but I have relied mainly on the form of the male abdomen, the pattern of the abdominal markings, and the shape and pattern of the wings.

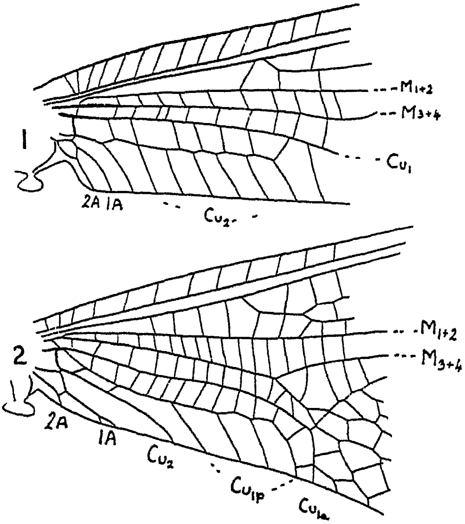
I have to thank Professor G. Hale Carpenter, of the Hope Department, Oxford, for his kindness in lending me the examples of *Stilbopteryx* in their museum, including the example figured by Duncan, and secondly Dr. H. Bischoff, of the Zoological Museum, Berlin, for allowing me to study some examples of *S. costalis* mentioned by Weele in his monograph.

Below I give the characteristics of the two subfamilies Stilbopteryginæ and Palparinæ.

STILBOPTERYGINÆ. (Figs. 1, 3.)

Antennæ short, slender, with abruptly clavate apices. Labial palpi not unusually long, about as long as maxillary. Body stout, in the male with dorsal elevations on abdominal segment 4 and sometimes also on segment 3. Anal appendages of ♂ short, plate-like. *Sc*+*R* is bent and runs at an angle to the costal margin. In the anterior wing 1 A is free, not coalescing with Cu_2; the first (posterior) branch of Rs, M_{1+2}, and Cu_{1a} parallel to each other. In the posterior wing there is no evident fork of M_{3+4}, no recurrent vein from Cu_1, and Cu_1 does not divide into anterior and posterior branches. In the ♂ there is a small clavate process on the anal margin of the posterior wing at its base.

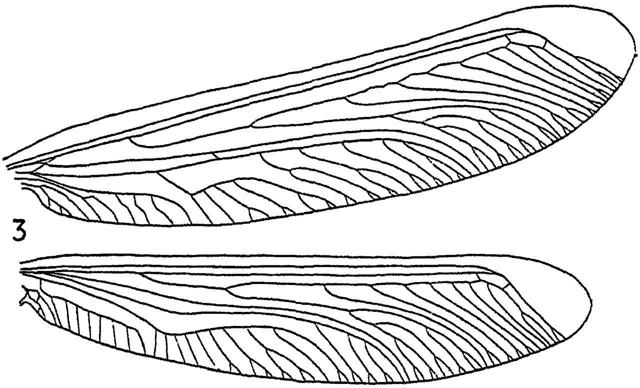
Genus: *Stilbopteryx.*



Base of posterior wing of male of:
1, *Stilbopteryx*; 2, *Palpares.*

Palparinæ. (Figs. 2, 4–5.)

Antennæ less short, less slender, and with more gradually clavate apices than in Stilbopteryginæ. Labial palpi much longer than maxillary (except *Pamexis*, *Tomatares*). Body stout, without dorsal elevations on abdominal segments in ♂. Anal appendages of ♂ variable in length, often long and cylindrical. $Sc+R$ generally running more or less parallel to the costal margin. In the anterior wing 1 A does not coalesce with Cu_2; at about the level of the stigma the first (posterior) branch of Rs and Cu_{1a} are curved towards each other and joined to M_{1+2}



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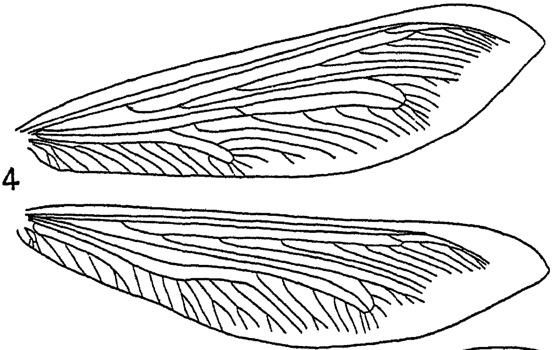

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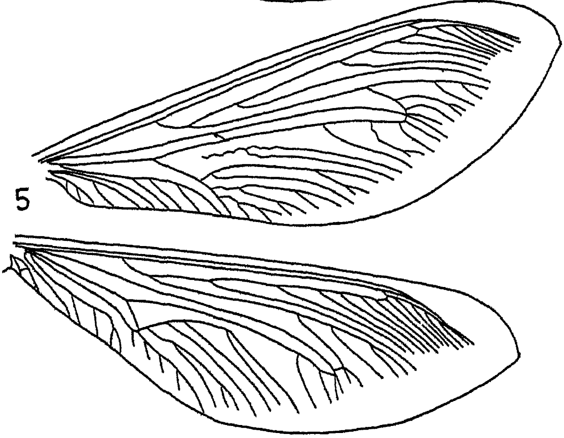


5

Diagrams of venation of:
3, *Stilbopteryx*; 4, *Palparidius*; 5, *Palpares*.

by well-defined cross-veins, producing a noticeable "loop-vein," which is sometimes shaded. In the posterior wing (except in *Palparidius* and *Pseudimares*) M_{3+4} has an obvious fork, from the junction of whose lower branch with Cu_{1a} arises a recurrent vein. Cu_{1p} present, except in *Palparidius* and *Pseudimares*. A clavate process on anal margin of posterior wing of ♂.

Genera: *Crambomorphus*, *Stenares*, *Negretus*, *Tomatares*, *Pamexis*, *Symmathetes*, *Palpares*, *Palparidus*, *Pseudimares*.

Stilbopteryx costalis Newman, 1838.

Newman, 1838, Entom. Mag. v. p. 400.
Duncan, 1840, in Jardine, Naturalist's Library, Ins. i. p. 294, pl. xxviii. fig. 2.
Walker, 1853, List Neur. Ins. B.M. ii. p. 454 (partim, specimen *b*).
Hagen, 1866, Stett. Ent. Z. xxvii. p. 460.
Weele, 1908, Cat. Coll. Selys, viii. p. 22 (partim).
Esben-Petersen, 1923, P. Linn. Soc. N.S.W. xlviii. p. 585.

Newman's description of the genus and species is as follows:—

(p. 399) " Genus STILBOPTERYX Newman.

" Caput transversum, pronum, cum oculis prothorace latius; antennæ capite duplò longiores, multi-articulatæ capitatæ: os sub pectore (p. 400) inclinatum; labrum transversum, lateribus rotundatis, medio subemarginatum; mandibulæ validæ, incurvæ, apice acutæ, intus dentibus duobus distantibus armatæ; maxillarum lacinia apice vix acuta, intus pilosa, basi unguiculo elevato instructa; galea fere linearis, laciniâ paullò longior, apice trifida; maxipalpi galeâ paullò longiores, 4-articulati, articuli longitudine subæquales; labium subquadratum valdé pilosum; labipalpi ligulâ æqualibus; ligula rotundata, apice emarginata, dente mediano obtuso; prothorax brevis, capite metathoraceque angustior: abdomen elongatum, lineare; alæ lineares, haud abdominem *sedentis* superinjicientes: tarsi 5-articulati.

" Stil. costalis. *Fusca*; *alæ nitidæ, hyalinæ, costis apicibusque latè fuscis*; *qualibet ala maculâ costali albâ ante apicem instructa.* (Corp. long. 1·85 unc.; alar. dilat. 4·85 unc.)

" Inhabits New Holland. This magnificent insect is evidently related to *Ascalaphus* and *Myrmeleon*."

Newman's type, which now lacks head and abdomen, is a female, judging by the absence of the clavate organ at the base of the posterior wings. The number of segments of the maxillary palpi given by Newman is incorrect, and should be five. The wings are broader and with denser venation than in other species of the genus. *M_{1+2} in both pairs of wings is clearly furcate near the margin.* This furcation is quite strong, and although it is roughly symmetrical in both pairs it may be an aberration. Another character which may be of systematic importance is the direction of the costal cross-veins, particularly in the anterior wing. In *costalis* they are set nearly at right angles to the costa, and in *napoleo* they are arranged obliquely. In addition to the type I have seen the female figured by Duncan (now in the University Museum, Oxford) and another, without locality, in the McLachlan collection, which agree in this matter of the costal cross-veins and also in the extent of the brown markings, but lack the furcation of M_{1+2}.

It will be noted that Newman does not mention any markings on the abdomen. In the female of *napoleo* there are large yellow abdominal spots, and I think one may justifiably presume that Newman's type either lacked markings or that they were small and inconspicuous as in the female figured by Duncan.

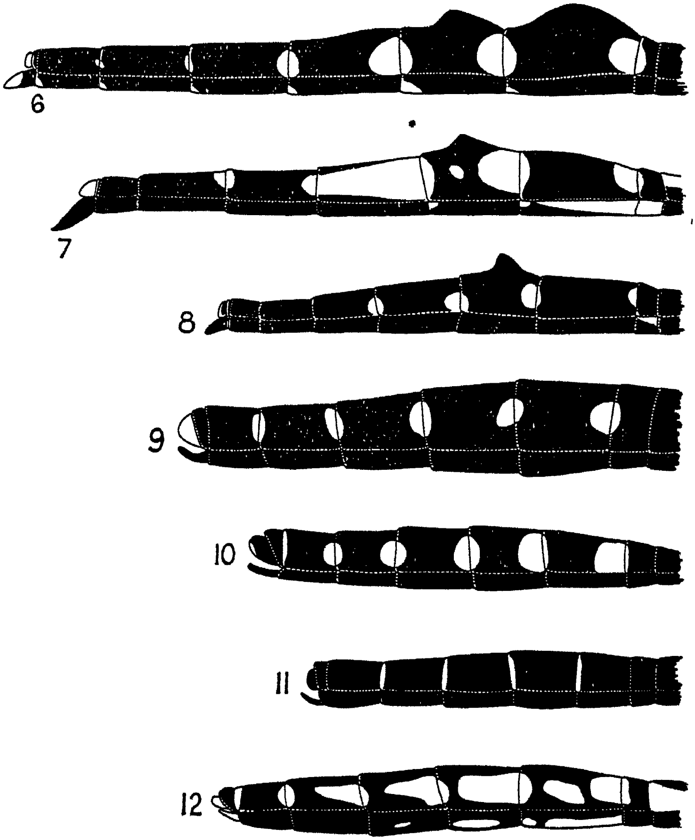
In abdominal markings *S. costalis*, ♀, resembles *S. walkeri*, sp. n., ♀, but the latter is distinguished by its more open venation, strongly curved Cu_2 in posterior wing, and different pattern of the brown markings. In *costalis* the brown costal streak extends to the radial sector in the anterior wing, but does not, or very rarely, reach it in *napoleo*.

I have also seen a male *Stilbopteryx* without locality in the McLachlan collection which may perhaps belong to *costalis*. The abdomen is somewhat distorted, but appears to be of the pattern of *S. walkeri*, sp. n., having one hump only and rather inconspicuous markings. In view of the absence of data I am not associating it definitely with *costalis* of Newman.

S. costalis of Tillyard (1916) cannot be the same as Newman's, as its posterior wing has hyaline spaces in the costal area ; the specimen in the Leiden Museum figured by Weele in 1908 is probably the same as Tillyard's *costalis*.

Stilbopteryx napoleo (Lefèbvre). (Figs. 6, 9, 13–17.)

Azesia napoleo Lefèbvre, 1842, in Guérin, Mag. Zool. Ins. p. 10, pl. xcii.; Rambur, 1842, Hist. Nat. Ins. Nevr. p. 364.
Stilbopteryx costalis Walker, 1853 (partim), List Neur. Ins. B.M. ii. p. 454 (specimen *a*).
=*Stilbopteryx napoleo* Hagen, 1866, Stett. Ent. Z. xxvii. p. 460; Esben-Petersen, 1923, P. Linn. Soc. N.S.W. xlviii. p. 585; Tillyard, 1926, Ins. Australia & N.Z. pl. xxiv. fig. 9.
=*Stilbopteryx dromedaria* Tillyard, 1916, P. Linn. Soc. N.S.W. xli. p. 67.



Diagrams of abdomens (lateral aspect) of *Stilbopteryx* spp.
6, *napoleo*, ♂; 7, *auricornis*, ♂; 8. *walkeri*, ♂; 9, *napoleo*, ♀; 10, *auricornis*, ♀; 11, *walkeri*, ♀; 12, *linearis*, ♀.

♂.—Head: epicranium dark piceous, clothed with fine silky hair of the same colour; antennæ dark piceous, joints of the segments with fine yellowish annulations, club blackish, basal segment of each antenna densely clothed with long black hairs. Eyes brown, frons black, hairy, clypeus and labrum golden-yellow.

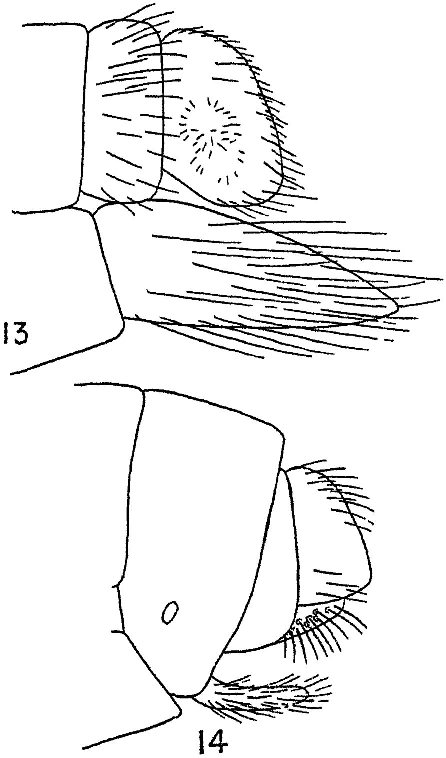
Thorax: pronotum transverse, dark piceous, anterior angles yellowish, the whole (especially the margins) clothed with long blackish hairs. Meso- and metathorax dark piceous, clothed above with dark brown hairs and laterally and ventrally with dense greyish hairs. Legs shining blackish, claws dark reddish brown.

Abdomen long, shining blackish with golden-yellow markings (fig. 6). Segments 1–2 short, segment 3 very long and swollen, particularly on its dorsal surface, where it forms a convex hump bearing short black setæ. Segment 4 long, but less swollen, its dorsal surface bearing a large prominence, slightly divided by a median longitudinal furrow, and armed with a number of stout black bristles. Segment 5 of about the same length as 4, tapering towards its apex from above. Segments 6–8 long, narrow, cylindrical. Ninth tergite very short, sternite produced in a large scoop-like subgenital plate with a pointed apex; it is golden-yellow, shading into brown at its base. Superior appendages yellow, about one-third the length of the subgenital plate (fig. 13).

Tenth sternite (concealed between the superior appendages) saddle-shaped, narrower towards its apex, to which is attached a pair of strongly chitinized "claspers." Ventrally this sternite is closed with a thin membrane, bearing a number of fine hairs, and towards its apex there is a more chitinized pocket, its opening directed tailward. Hypandrium small, compressed laterally, and from the side S-shaped (figs. 15–17).

Wings with blackish venation, except the bases of the anal veins, and many cross-veins in both wings, and the basal two-thirds of the costa and most of the costal cross-veins in the anterior wing. In this wing there is a blackish longitudinal streak from base to pterostigma, enclosing the subcosta and radius, but except at its base it does not extend to the radial sector. In its apical third it spreads into the costal area, but a hyaline area is left on either side of the costal cross-veins. Costal cross-veins oblique. Pterostigma bright yellow. Apices of both wings with a dark brown patch, whose inner margin is obliquely truncate, extending beyond the termination of the radial sector. In the hind wing the longitudinal streak occupies the entire costal and subcostal areas from base to pterostigma. Cu_2 in the hind wing is only slightly curved.

The female differs from the male in its broader wings and in the colour-pattern and decreased length of the abdomen, which is without swellings (fig. 9). The form of the anal appendages is shown in fig. 14.



Apex of abdomen of *Stilbopteryx napoleo* (Lef.), lateral aspect. 13, ♂; 14, ♀.

	♂.	♀.
Length of anterior wing	43–47	51–56 mm.
,, posterior ,, ...	39–42	48–50 ,,
,, body	60–62	48 ,,

Distribution.—Walker's specimen *a* is from the north or north-west coast of New Holland. All the remaining examples of this species in the British Museum are from West and South-west Australia.

This species resembles *S. costalis* in the condition of the brown costal band of the hind wing, but the distinctions have already been discussed under that species.

Stilbopteryx auricornis, sp. n. (Figs. 7, 10, 18.)

Stilbopteryx costalis Weele, 1908, Cat. Coll. Selys, viii. p. 23 (♂ from Sherlock River).

♂ (probably somewhat faded).—Head: epicranium dark fuscous, surface dull, almost bare, with only a few very short setæ; antenna with a tuft of black hairs on the basal segment, blackish except the club, which is golden-yellow; eyes large, brown; frons narrower than in *napoleo*, little wider than the basal segments of the antennæ, dark brown, almost without hairs; clypeus and labrum yellow.

Thorax fuscous, with yellowish-brown markings, clothed with pale hairs; markings as follows:—pronotum, anterior angles and posterior margins; mesonotum, a fine median line and the posterior margin; metanotum, the posterior margin. Femora and tibiæ piceous, remainder of legs reddish brown.

Abdomen long, dull blackish, with rather more extensive markings than in *napoleo* (fig. 7). Segments 1–2 short, 3 very long but scarcely swollen, 4 long, dilated dorsally into a pair of tubercles armed with stout black bristles, and separated by a shallow median furrow. Segment 5 about as long as 3, tapering to its apex, which is about half the diameter of its base. Segments 6–8 cylindrical, 8 shorter than 6 or 7. Ninth tergite short, sternite produced into a scoop-like subgenital plate much as in *napoleo*. Tenth sternite saddle-shaped, its lower basal angles narrower and more produced. Upper angle of "claspers" seen from the side produced and pointed. Hypandrium less sinuate (fig. 18).

Wings with black venation, except the costa and its cross-veins and the veins in an area parallel to and behind the radial sector, which are yellowish. In the anterior wing there is a broad brown band from base to pterostigma, occupying an area between the subcosta and the radial sector and base of the cubitus. Between the radius and its sector the colouring is paler in the centre of the cellules. The brownish colour also extends into the costal area in its apical half. Pterostigma yellowish. Apical brown patch smaller than in *napoleo,* scarcely extending behind, and subparallel to the radial sector. Posterior wing similarly marked, but the brown streak is less extensive at its base.

♀.—Much blacker (less faded) than ♂. Abdomen short, without swellings, dull blackish with yellow markings (fig. 10). Anal appendages scarcely differing from *napoleo,* superior appendages more rounded.

Anterior wings similar to male, but the pale venation behind the radial sector less noticeable. Posterior wing: the brown streak occupying in addition most of the costal area except the base. Apical patches in both wings more oblique.

	♂.	♀.
Length of anterior wing	49	46 mm.
,, posterior ,, ...	46	42 ,,
,, body	56	41 ,,

West Australia, Sherlock River (*Dr. Clement*), type ♂; Yanchep, 32 miles north of Perth, 9–23. i. 36 (*Miss A. Raymond*), paratype ♀, in the collection of the British Museum.

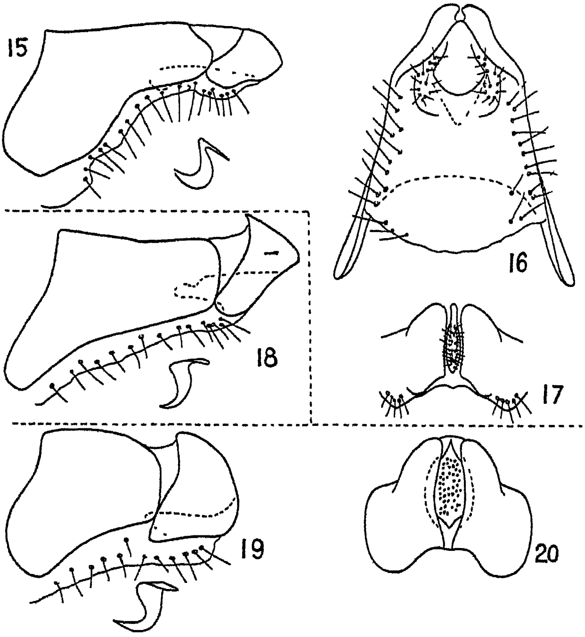
The most noticeable distinction between this species and *S. napoleo* is the bright golden club of the antenna. It also differs in the dull black of the abdomen and in the markings of the wings and abdomen. Weele suggests that a female from South Australia in the British Museum collection (subsequently described by Navás as *S. linearis*) is probably conspecific with the ♂ here described. There are a number of differences in wing-markings which, I think, are sufficient to justify its separation as a distinct species. I have seen a male in the collection of the Zoological Museum, Berlin, which is possibly a new species related to *auricornis.* It differs in its more pointed wings, reduced colour-pattern of abdomen, and duller antennæ. As there is only one example I am leaving it without a name.

Stilbopteryx walkeri, sp. n. (Figs. 8, 11, 19, 20.)

Stilbopteryx costalis Walker, 1853, List. Neur. Ins. B.M. ii. p. 454 (partim, specimen " C ").

? *Stilbopteryx costalis* Weele, 1908, Cat. Coll. Selys, viii. p. 22, fig. 1 (♀ Leiden Mus.); Tillyard, 1916, P. Linn. Soc. N.S.W. xli. p. 69, figs. 1 B, 2 B, 3 B.

♂.—Head: epicranium dark fuscous, anteriorly with fine tawny hairs; antenna piceous, rather longer than in *napoleo*, basal segment with a tuft of black hairs, remaining segments as far as the club with the joints finely annulated with yellowish; eyes brown, frons blackish, hairy, clypeus and labrum golden-yellow.



Tenth sternite and associated structures in *Stilbopteryx* spp., ♂.

S. napoleo (Lef.): 15, tenth sternite and hypandrium, lateral; 16, tenth sternite, ventral; 17, "claspers" from behind. *S. auricornis*, sp. n.: 18, tenth sternite and hypandrium, lateral. *S. walkeri*, sp. n.: 19, tenth sternite and hypandrium, lateral; 20, " claspers " from behind.

Thorax fuscous, dorsally with brown hairs, laterally and ventrally paler; pronotum with the anterior angles and posterior margin paler. Legs shining dark reddish brown.

Abdomen of moderate length, not dilated laterally, fuscous, with blackish hairs and a very fine tawny pubescence or pruinescence and yellowish markings as in fig. 8. Segments 1–2 short, 3 long, not dilated, 4 about two-thirds as long as 3, with a strong dorsal prominence about midway armed with stout black spines; 6–8 decreasing in length; ninth tergite short, sternite scoop-shaped. Tenth sternite saddle-shaped, shorter than the preceding species, lower basal angles more rounded. "Claspers" large and strong, the chitinous plate between them broader (figs. 19 & 20).

Wings with black venation, except the basal half of the costa in both wings and the costal cross-veins in the anterior, which are yellowish. Pterostigma yellowish. Brown streak in anterior wing occupying the apical third of the costal, the subcostal, and all except the apical portion of the radial area. Cells in the radial area with paler centres and most cross-veins in the costal area with hyaline margins. Apical brown patch in both wings with its inner margin oblique, not extending beyond the termination of the radial sector. In the posterior wing the brown streak occupies the subcostal area and the apical half of the costal area; in the basal half the anterior part of the costal area becomes increasingly hyaline as one approaches the base. Clavate process short-oval (4 : 3), with golden-brown "scent-hairs."

♀.—Resembling the male, but without processes on the abdomen (fig. 11); colour of fine pubescence, greyish rather than yellowish. Brown bands of wings less heavily marked, apical patches smaller, posterior margins subparallel with radial sector. Cu_2 in posterior wing distinctly curved.

	♂.	♀.
Length of anterior wing	47	44
,, posterior ,, ...	43	39
,, body	50	38

Queensland: type, ♂, from Moreton Bay, paratypes, ♂♀, from various localities, in British Museum (Nat. Hist.); 1 ♂, 1 ♀, paratypes, from New Holland, in the Zoological Museum in Berlin.

Stilbopteryx linearis Navás, 1911. (Fig. 12.)

Stilbopteryx linearis Navás, Ent. Rundsch. xxviii. p. 12; Esben-Petersen, 1923, P. Linn. Soc. N.S.W. xlviii. p. 585; Tillyard 1926, Ins. Austral. N. Z. p. 324.

♂.—Unknown.

♀ (dried, after preservation in spirit).—Epicranium and frons fuscous, bare (? denuded), antennæ wanting, except basal segments, which bear tawny hairs; clypeus and labrum yellow.

Prothorax transverse, dark fuscous, anterior and posterior margins golden-yellow, with traces of tawny hairs. Meso- and metathorax dark fuscous, with silky tawny hair. Legs reddish brown.

Abdomen of medium length, piceous, with numerous large golden-yellow spots as in fig. 12.

Posterior margins of the wings much abraded. Venation dark except the costa and its cross-veins and in a longitudinal area behind the radial sector. Brown streak narrow, occupying the subcostal area and only slightly invading the radial area. Apical patch very narrow, bordering the costa, tapering from base to apex. Cu_2 in posterior wing strongly curved.

Length of anterior wing	50 mm. (approx.).
,, posterior ,, ...	46 ,, ,,
,, body	48 ,,

South Australia, Killalpanima, 100 miles E. of L. Eyre (*H. J. Hillier*).

Type, ♀, in the British Museum.

The pattern of wings and abdomen will serve to separate this species from any other in this genus known as yet.

XLII.—*The Fishes of the Gobiid Genus* Luciogobius *Gill.*

By C. Tate Regan, D.Sc., F.R.S.

In his synopsis of the Gobioids of Japan, Tomiyama mentions several species and subspecies that he considers to be polymorphic. One of these is *Luciogobius guttatus guttatus* Gill, in the synonymy of which Tomiyama places *L. elongatus* Regan. After re-examination of the types of *L. elongatus*, and comparison with specimens of *L. guttatus*, I consider these to be two quite good species. I also regard two forms described and figured by Tomiyama, one from a cave, the other from an artesian well, as specifically distinct from *L. guttatus*.

Tomiyama includes *Inu* and *Expedio* of Snyder in *Luciogobius*. *Inu* differs from *Luciogobius* in having the body partly scaled. This is not necessarily a generic difference, but from Snyder's figures (Proc. U.S. Nat. Mus. xlii. 1912, pl. lx. figs. 2, 3) I am not convinced that the two species he describes are nearly related to *Luciogobius*. It is not impossible that in *Inu* and *Luciogobius* the spinous dorsal fin has been lost independently, and that *Astrape* and *Clariger* respectively may represent the types from which they have originated. There is more to be said for the inclusion of *Expedio parvulus* in *Luciogobius*. The pelvic fins are very small in *L. elongatus*, and absent in *E. parvulus*; but as the two species are evidently closely related it seems undesirable to separate them generically on this account.

LUCIOGOBIUS Gill, 1859.

Proc. Acad. Philadelphia, 1859, p. 146; Jordan and Snyder, Proc. U.S. Nat. Mus. xxiv. 1901, p. 123; Tomiyama, Japanese J. Zool. vii. (1) 1936, p. 51.
Expedio Snyder, Proc. U.S. Nat. Mus. xxxvi. 1909, p. 606.

Elongate; naked. Cheeks swollen; mouth terminal, oblique; lower jaw projecting; small pointed teeth in jaws. Gill-opening subvertical, in front of base of pectoral. No spinous dorsal; soft dorsal and anal of 7 to 15 rays; caudal rounded. Pectorals rounded; pelvics variously developed, generally small, in one species absent.

Synopsis of the Species.

I. Eyes normally developed, rather prominent; dorsal fin low; numerous small dark spots on body Marine, littoral.
  D. 12–15. A. 12–15. Depth 6½ to 9, head 4 to 5 in length. Pelvics rather small .... 1. *guttatus*.
  D. 7–9. A. 8–10. Depth 10 to 12 or more, head 7 to 8 in length. Pelvics very small......... 2. *elongatus*.
  D. 9–10. A. 11. Depth 11, head 6 in length. Pelvics absent .... 3. *parvulus*.
II. Eyes reduced; dorsal fin high, with 10 or 11 rays; no spots on body. Inhabiting caves, or underground waters.
  Eyes small, subcutaneous; depth 13, head 5 in length; pale, apparently lightly pigmented .... 4. *pallidus*.
  Eyes vestigial; depth nearly 9, head 3½ in length; unpigmented .... 5. *albus*.

1. *Luciogobius guttatus* Gill, 1859.

Proc. Acad. Philadelphia, 1859, p. 146; Jordan and Snyder, Proc. U.S. Nat. Mus. xxiv. 1901, p. 123, figs. 29, 30.
Luciogobius guttatus guttatus (part., Tomiyama, Japanese J. Zool. vii. (1) 1936, p. 51, fig. 10, A, B.

Eyes normal. Depth 6½ to 9 in length, length of head 4 to 5. Dorsal 12–15; base generally longer than caudal peduncle; longest ray shorter than depth of tail. Anal 12–15. Pelvics rather small, but normally developed. Numerous small dark spots, and generally some small, but larger, pale ones on body.

JAPAN; COREA.

On muddy shores—among stones—in rock pools—under rocks in sandy pools at low tide (*Jordan & Snyder*). Here described from several specimens, up to 55 mm. in length, from the Inland Sea. The species reaches a length of 95 mm. (*Tomiyama*).

2. *Luciogobius elongatus* Regan, 1905.

Ann. & Mag. Nat. Hist. (7) xv. p. 23.

Eyes normal. Depth 10 to 12 or more in length, length of head 7 to 8. Dorsal 7–9; base much shorter than caudal peduncle. Anal 8–10. Pelvics represented by a very small flap, with the rays indistinct. Numerous small dark spots on body.

Several specimens, up to 40 mm. in length, from the Inland Sea of Japan.

Compared with examples of *L. guttatus*, also collected in the Inland Sea by Mr. R. Gordon Smith, this species is seen to differ in its more slender form, smaller head, shorter dorsal and anal fins with fewer rays, smaller pelvics, and longer caudal peduncle (about 12 myotomes instead of 8 behind dorsal fin).

The reduction of the pelvics in this species, and their loss in *L. parvulus*, may perhaps be related to burrowing habits.

3. *Luciogobius parvulus* Snyder, 1909.

Expedio parvulus Snyder, Proc. U.S. Nat. Mus. xxxvi. p. 606, and xlii. 1912, p. 445, pl. lxi. fig. 1.
Luciogobius guttatus parvulus Tomiyama, Japanese J. Zool. vii. (1) 1936, p. 51.

Eyes normal. Depth 11 in length, length of head 6. Dorsal 9 or 10; longest ray less than depth of tail;

base shorter than caudal peduncle. Anal 11. Pelvics absent. Numerous small dark spots on body.

JAPAN : Misaki.

Length of the unique type 37 mm.

4. *Luciogobius pallidus*, sp. n.

Luciogobius guttatus guttatus (part.) Tomiyama, Japanese J. Zool. vii. (1) 1936, p. 51, fig. 10, D.

Eyes small, subcutaneous. Depth about 13 in length, length of head 5. Dorsal 10 or 11 (?), high, the longest ray much longer than depth of tail. Anal 11, lower than dorsal. Pelvics normally developed. Pale ; apparently lightly pigmented.

JAPAN : from an artesian well.

Tomiyama had three specimens, 35 to 65 mm. long.

5. *Luciogobius albus*, sp. n.

Luciogobius guttatus guttatus (part.) Tomiyama, Japanese J. Zool. vii. (1) 1936, p. 51, fig. 10, C.

Eyes vestigial. Depth of body nearly 9 in length, length of head 3½. Lips thick. All the fins large. Dorsal 10 ; longest ray longer than depth of tail. Anal 10. Pelvics normally developed. White, unpigmented.

JAPAN : Cave of Daikon-zima, Simani-ken.

Tomiyama had two specimens, 45 mm. long.

XLIII.—*Note on the Yugoslavian Ground-Squirrels (Sousliks).* By V. & E. MARTINO. (From the Department of Zoology, British Museum (Natural History).)

THANKS to the help of the Trustees of British Museum we were able during 1937, among other explorations, to clear up the geographical distribution of the Yugoslavian forms of the ground-squirrels, two of which must be described as new.

1. *Citellus citellus karamani*, subsp. n.

Type.—Collector's no. 223/37 (British Museum no. 1938. 12. 27. 1), collected by V. Martino, 1 August, 1937.

Type-locality.—Karadjica Mountains, above Patiška, 30 km. S. of Skoplje, South Serbia (Macedonia). Alt. 2000 m.

Range.—Known only from the tableland of Karadjica Mountains between 2000–2200 m.

Characters.—Size and colour nearly as in typical *Citellus citellus* *. Zygomatic breadth rather larger (average of relation of condylo-basal length to zygomatic breadth 1·46 instead of 1·52) and arches more rounded, but bones of zygomatic arches weakly developed ; its lower border usually without convex lobe. Brain-case broader. Teeth weakly developed. Lower tooth-row shorter ; its alveolar length usually less than 9 mm., and contained in condylo-basal length 4·9 times instead of 4·5 in typical subspecies. Furrows on the surface of upper molars longer, occupying larger part of a transverse diameter of the tooth than in the typical subspecies.

Systematic Remarks.—

1. Relation of condylo-basal length to zygomatic breadth:

		1·44.	1·46.	1·48.	1·50.	1·52.	1·54.	1·56.
Citellus citellus citellus L.	Topotype specimen from Wagram. Orig. no. 1150.	..	..	..	..	..	♀	
	Specimens from Znaim (from G. Miller).	..	..	♀	♂	..	♀	
		..	..	..	♀	..	♀	
		..	..	..	♀			
	C. c. karamani. Karadjica Mountains, S. Serbia.	♂ ♀ ♀ ♀	♂ ♂ ♀ ♀	♀ ♀ ♀	♀ ♀			

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* Thanks to the kindness of Messrs. O. Wettstein and K. Zalesky we have received one specimen of *Citellus citellus* from Wagram (Austria), which we accept here as topotype. This specimen, together with the specimens in the British Museum from Znaim (Mahren), indicates that Austrian ground-squirrels (practically typical *C. c. citellus*) are large enough, with the condylo-basal length 42–45 mm. and hind foot 35–37 mm. (1). Therefore we think that Mr. Obolensky (2) makes a mistake marking out as typical condylo-basal length only 40·7 mm. Probably he measured young specimens or small steppe subspecies. Unfortunately it is very difficult to use the measurements in the circumstantial and interesting work of Mr. Calinescu (3), because it contains a great number of *lapsus calami*.

2. Relation of condylo-basal length to length of lower tooth-row in *C. c. citellus* L. (Miller's measurements) and *C. c. karamani*:

		4·2.	4·3.	4·4.	4·5.	4·6.	4·7.	4·8.	4·9.	5·0.	5·3.
Citellus citellus citellus L.	Topotype specimen from Wagram. Orig. no. 1150.	..	..	..	..	..	♀				
	Specimens from Znaim (from G. Miller).	..	..	..	♀	♀	♀	♂	♂		
		..	..	..	♀						
Perhaps not true *C. c. citellus.*	Specimens from Hirschberg, Bohemia (G. Miller).	♂	..	♂	♀						
		..	..	♀	♀						
	C. c. karamani Karadjica Mountains, S. Serbia.	..	..	..	..	..	♀	♀	♂	♂	♀
		..	..	..	..	..	..	..	♀	♀	
		..	..	..	..	..	..	..	♀	♀	
		..	..	..	..	..	..	..	♀	♀	
		..	..	..	..	..	..	..	♀		
		..	..	..	..	..	..	..	♀		
		..	..	..	..	..	..	..	♀		

3. Relation of condylo-basal length to length of lower tooth-row in *C. citellus* from northern Jugoslavia and *C. c. karamani* (our measurements).

	4·2.	4·3.	4·4.	4·5.	4·6.	4·7.	4·8.	4·9.	5·0.	5·3.
C. citellus from Čortanovci, Fruškagora Mountains, Srem.	♀	♀	♀	♂	♀	♂	..	♂ (very much worn).		
	..	♀		♀	♀	♂				
	..	♀	..	♂	♀	♀				
(Intermediate between *C. c. citellus* and *C. c. laskarevi*).	..	..	..	♀						
C. c. karamani. KaradjicaMountains, S. Serbia.	..	..	..	..	..	♀	♀	♂	♂	♀
	..	..	..	..	..	..	..	♀	♀	
	..	..	..	..	..	..	..	♀	♀	
	..	..	..	..	..	..	..	♀	♀	
	..	..	..	..	..	..	..	♀		
	..	..	..	..	..	..	..	♀		
	..	..	..	..	..	..	..	♀		

Ecological Remarks.—The new subspecies lives on the high clearly limited tableland with a short but uninterrupted summer vegetative period, during which there is always much green grass. In consequence the ground-squirrels here eat dry grain very rarely, perhaps only at the end of the summer. Probably the weaker development of teeth and zygomatic bones is correlated with the last ecological condition. As to the greater breadth of brain-case, which is observed very often in different mountain forms of mammals, we cannot find a satisfactory ecological explanation.

Measurements of Body.—Type: head and body 210; tail 65; hind foot 35·5; ear 9·2 mm. Fourteen adult paratypes (minimum and maximum): head and body 205–230; tail 47–67; hind foot 34–37·5; ear 8·8–10·5 mm.

Cranial Measurements.—Type: condylo-basal length 42·5; zygomatic breadth 29·3; interorbital breadth 10·0; diastema 11·0; maxillary tooth-row 9·0; mandibulary tooth-row 8·5 mm. Fourteen adult paratypes (minimum and maximum): condylo-basal length 42·0–44·3; zygomatic breadth 28·2–30·2; interorbital breadth 9·8–10·3; diastema 10·6–12·0; maxillary tooth-row 9·0–9·8; mandibular tooth-row 8·5–9·0 mm.

Nomenclature Remarks.—Named in honour of Dr. Stanko Karaman, the well-known explorer of Macedonian fauna.

Specimens examined.—Collector's no. of paratypes: 210–37; 211–37; 212–37; 219–37; 220–37; 221–37; 222–37; 224–37; 233–37; 234–37, 235–37; 244–37; 245–37; and orig. no. 1034.

2. *Citellus citellus laskarevi*, subsp. n.

Type.—Collector's no. 54–38 (British Museum no. 1938.12.27.2), collected by B. Petrov, 15 May, 1938.

Type-locality.—Dolovo, S.E. Banat, Jugoslavia.

Range.—Lowland of Banat and Srem. On the steppe hills near Fruškagora Mountains dwell larger specimens intermediate to *C. c. citellus* L.

Characters.—Colour and configuration of skull and teeth essentially as in typical form, but size smaller: in adults, condylo-basal length 38·4–42·5 instead of 42·0–45·0 mm. and hind foot 30–35 instead of 35–37 mm. Tail short, not rarely shorter than one-quarter of head and body.

Systematic Remarks.—Relation between condylo-basal length of new subspecies and *Citellus citellus citellus* :

					38.–39.	39.–40.	40–41.	41.–42.	42.–43.	43.–44.	44.–45.
Citellus citellus citellus.	Wagram, Austria. Oıig. no. 1150.				. .	. .	. .	. .	. .	♀	
	Specimens from Znaim (from G. Miller).				. .	. .	. .	. .	♀	♀	♀
					. .	. .	. .	. .	. .	♀	♂
					. .	. .	. .	. .	. .	. .	♂
Citellus citellus laskarevi, subsp. n.									Fruškagora hills.		
	Srem.	. .	. .	. .	. .	♀	♀	♀	♀	♂	♂
		. .	. .	. .	. .	♂	♀	♀	♀		
		. .	. .	. .	. .	. .	♀	♀	♂		
		. .	. .	. .	. .	. .	♀	♂			
		. .	. .	. .	. .	. .	♀	♂			
		. .	. .	. .	. .	. .	♂				
	Banat.	. .	. .	. .	♀	♀	♂	♂	♂		
		. .	. .	. .	♂	♀	♂	♂	♂		
		. .	. .	. .	. .	. .	♂	♂			
		. .	. .	. .	. .	. .	♀	♂ ♂			
		. .	. .	. .	. .	. .	♀	♀			
		. .	. .	. .	. .	. .	♀	♀			

Ecological Remarks.—Apparently the European ground-squirrel finds its best ecological condition in a hilly country with brooklets in the valleys. Here it reaches a large size, which decreases in the dried steppe lowlands with long summer vegetative interruption.

The shorter tail of this subspecies corresponds to Brauner's ecological rule.

Measurements of Body.—Type : head and body 190·0 ; tail 45·0 ; hind foot 30·5 ; ear 8·5 mm. Fifteen adult paratypes (minimum and maximum) : head and body 185·0–210·0 ; tail 39·0–58·0 ; hind foot 29·6–34·5 ; ear 8·0–9·0 mm.

Cranial Measurements.—Type : condylo-basal length 39·2 ; zygomatic breadth 26·5 ; interorbital breadth 8·5 ; diastema 9·8 ; maxilllary tooth-row 9·4 ; mandibular tooth-row 8·7 mm. Fifteen adult paratypes (minimum and maximum) : condylo-basal length 38·4–42·3 ; zygomatic breadth 25·8–28·0 ; interorbital breadth 8·0–9·3 ; diastema 10·0–12·0 ; maxillary tooth-row 9·0–10·0 ; mandibular tooth-row 8·5–9·2 mm.

Nomenclature Remarks.—Named in honour of Dr. V. Laskarev, Professor of the University, Beograd.

Key to Yugoslavian Forms of Citellus, *and their relation to typical form.*

a. General colour of upper parts more yellow and uniform; the speckles nearly absent. Colour of underparts buff-yellow. Dark subterminal band on the tail hair-pencil scarcely developed, usually light brownish. Skull larger; condylo-basal length: average 44·5, maximum 46 mm.; zygomatic breadth: average 30·4, maximum 32 mm. .... *C. citellus gradojevići* [Martino (4).

b. General colour of upper parts more greyish or brownish, with lighter "cinnamon-pinkish buff" speckles. Colour of underparts cream-buff or buff-whitish. Dark subterminal band on the tail hair-pencil clearly developed, blackish. Skull not so large; condylo-basal length: average smaller than 44, maximum smaller than 45 mm.; zygomatic breadth: average less than 29·5 mm., maximum less than 31 mm.

  *a*¹. Size very small: condylo-basal length 38–42·5 mm. (average 40·5); zygomatic breadth 26–28·5 mm.; hind foot 30–35 mm. .... *C. citellus laskarevi,* [subsp. n.

  *b*¹. Size larger: condylo-basal length 42–45 mm (average 43·6); zygomatic breadth 28–30·4 mm.; hind foot 34–37 mm.

    *a*². Zygomatic breadth slightly larger and zygomatic arches more rounded, but its bones weakly developed, without convex lobe on the lower border.
    Length of lower tooth-row contained nearly 4·9 times in the condylo-basal length. The transverse furrows on the surface of upper molars usually occupy nearly three-quarters of the transverse diameter of the tooth .... *C. citellus karamani,* [subsp. n.

    *b*². Zygomatic breadth narrower and triangle-like in outline; its bones more robust, with convex lobe on the lower border.
    Length of lower tooth-row contained nearly 4·5 times in the condylo-basal length. The transverse furrows on the surface of upper molars usually occupy nearly half of the transverse diameter of the tooth .... *C. citellus citellus* L.

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(3) R. Calinescu. "Taxonom., biolog. und biogeografische Forschungen über Gattung *Citellus* in Rumänien." 'Zeitschrift für Säugetierkunde,' Band 9, p. 87. Berlin, 1937.
(4) V. & E. Martino. "A new Souslik from Macedonia." 'Journal of Mammalogy,' vol. x, p. 76. Baltimore, 1929.

XLIV.—Melanagromyza coffeæ, *sp. n.*, *a Leaf-Miner of the Coffee-Plant.* By E. M. Hering.

The main characters of the new species are: the lack of a metallic sheen, which characterises so many species of this genus, the single *ori*, the *c* only reaching r_{4+5}, as well as the position of *ta* far beyond the middle of the *Cd.*

Head slightly compressed antero-posteriorly, the lower margin only half as long as the hind margin. Frons rather narrow, as wide above as one eye, appreciably narrowed towards the base of antennæ. The latter inserted opposite the middle of the eyes, their bases slightly separated, the not very marked median keel of the face entering between them as a narrow edge. The lunula is low, somewhat lower than a semicircle, as high as the part of the interfrontals situated between the apex of the ocellar plate and the lunula; the latter with a linear median longitudinal impression. Antennæ small, the third joint orbicular, with the arista microscopically pubescent and very long, about five times as long as the diameter of the third joint. Frons and parafacials nowhere protruding beyond the eyes, when seen in profile. The mouth-margin is somewhat produced and raised, lying slightly above the lower margin of the eyes. Jowls at their widest point (behind) only one-tenth as high as the vertical diameter of eye, narrowed in front. Palpi filiform, hardly dilated towards apex, the latter setose. Labella of haustellum elongate, as long as the lower margin of head, but fleshy, not sclerotised. Each orbit about one-fifth as wide as the inter-frontals at the level of the ocelli, strongly narrowed in front and lineiform near the antennæ. The ocelli on a triangle with slightly obtuse angles, the apex of the ocellar plate between the second and third *ors.*

Setæ of head: *vte*, *vti*, long and strongly diverging *pvt*, long and strong *oc*, the apices of which almost reach the third *ors*, three *ors*, the anterior one shorter, all three directed upwards, and one inwardly directed *ori* are present; *vi* not much stronger than the setæ on mouth-margin.

Thorax without *prscut*, and with only two *dc*, the posterior one slightly in front of the posterior *sa*, the anterior one more in front of the anterior *sa*, though appreciably behind the suture. A weak *ia* between the two *dc*, and a still weaker one, which is almost hair-like, at the end of the thorax. The *acr* hairs in 8–10 longitudinal rows in front up to the level of the anterior *dc*, but much sparser behind the latter and ending in front of or at the posterior *dc*. About five rows of small hairs in the *ia* stripe, which become sparse behind and vanish near the anterior *ia*. Scutellum with four *sc*. One *h*, one *prsut*, two *notpl*, only one *mpl* (almost in the middle of the hind margin of the mesopleura), and one *stpl*. Smaller hairs are present at the hind margin of the mesopleura, less numerous near its upper margin, and rather numerous at the upper margin of the sternopleura.

Abdomen: the last segment of both sexes as long as the penultimate one, the basal segment of the ovipositor not longer than the last segment, broad, about twice as wide as long.

Legs normal, the t_2 towards the end of the postero-exterior surface with a small setula which hardly stands out from the pubescence.

Wings with the characters of the genus; *ta* and *tp* distant by less than the length of *tp*, usually by that of *ta*; *c* only reaching r_{4+5}. The second section of the wing-margin about two-and-a-half times as long as the third section, the latter as long as the fourth. Last section of *cu* about as long as the last but one. The *an* not reaching the margin. Apex of wing approximately at the tip of r_{4+5}, so that *m* ends below the tip of the wing. Alar and thoracic calyptræ of almost equal size.

Coloration: black all over, with faint grey dust, which produces a silky gloss. The abdomen somewhat more shiny. Halteres, calyptræ and the fringes of the latter brown.

Smallish species of about 2 mm. length.

♂ type, bred from mines in leaves of *Coffea arabica*. The label reads: "TANGANYIKA: Amani, i. 1939, *T. W. Kirkpatrick*." Submitted by the Imperial Institute of Entomology, London. Type in the British Museum (Natural History).

(*a*) Condylo-basal length (in millimetres).

	14·0.	14·2.	14·4.	14·6.	14·8.	15·0.	15·2.	15·4.	15·6.	15 8.	16·0.	16·2.	16·4.	16·6.
Northern Europe.	♂	♂	♂	♀	♂	4 ♂	♂	♂	..	♂				
	..	..	..	..	..	2 ♀	2 ♀	♀						
South-eastern Europe.	..	..	..	..	..	..	..	..	..	♂	♀	♂	6 ♀	♀
	..	..	..	..	..	..	..	..	..	..	o *	3 ♀		
	..	..	..	..	..	..	..	..	..	..	..	o		

(*b*) Zygomatic breadth.

	8.	8·2.	8·4.	8·6.	8·8.	9·0.	9·2	9·4.	9·6.
Northern Europe.	♀	.	2 ♂	4 ♂	3 ♂	♂			
	..	..	♀	♀	♀	2 ♀			
South-eastern Europe.	..	..	..	..	..	2 ♂	4 ♀	♂	♀
	..	..	..	..	..	2 ♀	..	4 ♀	o

(*c*) Upper tooth-row.

	4·8.	5·0.	5·2.	5·4.	5·6.	5·8.	6·0.
Northern Europe.	♂	5 ♂	3 ♂	2 ♂	..	♂	
	..	♀	2 ♀	2 ♀			
South-eastern Europe.	..	..	..	..	..	♂	♂
	..	..	..	..	..	3 ♀	7 ♀
	..	..	..	..	..	2 o	

* o, sex unknown.

10·8 (10·6); upper tooth-row 6·1 (5·98); lower tooth-row 6·6 (6·6); length of bullæ 4·7 (4·5).

Specimens examined.—Collection of the British Museum: type and nine paratypes from type-locality: collector's no. 124/36; 125/36; 126/36; 127/36; 136/36; 139/36; 140/36; 141/36; no. 142/36.

Martino's collection: paratype from type-locality, no. 1058, and nos. 718, 756, 764 from Beograd, Serbia, and no. 464 from Aleksinac, Serbia.

3. *Dolomys bogdanovi preniensis*, subsp. n.

Type.—Collector's no. 314/36 (B.M. no. 1937.4.16.45), female, collected August 11, 1936, by V. Martino.

Type-locality.—Crno Polje, Prenj Mountains, Hercegovina. Alt. 1300–1800 mm.

Characters.—Similar to *D. b. bogdanovi*, but slightly smaller and hind foot noticeably shorter. Colour in adult age paler; buffy greyish instead of greyish brown.

External Measurements.—Type: head and body 130·0 mm.; tail 88·0; hind foot 23·8; ear 19·0.

Cranial Measurements.—Condylo-basal length 32·6 mm.; zygomatic breadth 19·2; interorbital constriction 4·4; occipital breadth 15·2; nasal length 9·9; diastema 10·1; upper molars (alveolar) 8·1; mandible 21·2; lower molars 8·1.

Specimens examined.—Type and three paratypes (young). Collection of the British Museum: collector's nos. 231/36; 317/36; 213/36.

Martino's collection, no. 1076.

4. *Chionomys nivalis wagneri*, subsp. n.

Type.—Collector's no. 89/36 (B.M. no. 1937.4.16.41), female, collected 15 July, 1936, by B. Martino.

Type-locality.—Zgornja Krma, Triglav Mountains, W. Slovernia. Alt. 1750 m.

Range.—Triglav Mountains.

Characters.—Size and colour as in *Ch. nivalis nivalis.* Anterior loop of first lower molar in form of equilateral triangle distinctly directed outwards from longitudinal axis of the tooth-row. The posterior loop of third upper molar is short and rounded as in *Ch. n. malyi*, but interorbital constriction about 4 mm. instead of 4·9 in the last subspecies.

External Measurements.—Type and max. and min. of four paratypes in parentheses: head and body 110 mm. (115–122); tail 55 (58–79); hind foot 20 (20·8–21·0); ear 15 (15–16).

Cranial Measurements.—Type and max. and min. of four paratypes in parentheses: condylo-basal length 28·8 mm. (29·0–30·0); zygomatic breadth 16·6 (16·2–16·8); interobital constriction 4·0 (3·9–4·0); nasal length 7·6 (7·8–8·0); diastema 8·9 (9·0–9·2); mandible 18·2 (18·0–19·0); upper molars (alveolar) 6·7 (6·2–7·0); lower molars 6·5 (6·2–6·7).

Specimens examined.—Collection of the British Museum: type and three paratypes: collector's no. 87/36; 88/36; 196/36.

Martino's collection, no. 1066 (paratype).

5. *Pitymys multiplex hercegoviniensis*, subsp. n.

Type.—Collector's no. 320/36 (B.M. no. 1937.4.24.62), collected August 15, 1936, by V. Martino and J. Grebenščikov.

Type-locality.—Tisovica karst field, Prenj Mountains, Hercegovina.

Range.—Karst field on the Prenj Mountains.

Characters.—Upper parts with strong buffy suffusion, underparts silver whitish grey without buffy tinge. Hind feet above usually whitish grey. Tail bicolor: brownish above and nearly white below. Depth of braincase, including auditory bullæ, about 70 per cent. of occipital breadth. Skull moderately large: condylo-basal length 23·0–24·2 mm. Inner border of posterior triangle, m^2 with tendency to develop evident convexity.

Systematic Remarks.—The colour is very similar to *P. incertoides*, but size larger: condylo-basal length 23–24 mm. instead of 21·4–22·0, and skull more convex.

External Measurements.—Type and four paratypes in parentheses: head and body 93 mm. (92, 93, 91, 86 subad.); tail 31·0 (31·5, 36·5, 31·0, 29·0); hind foot 15·2 (14·8, 15·3, 14·8, 14·2); ear 8·5 (8·0, 9·0, 7·5, 8·0).

Cranial Measurements.—Type and three adult paratypes in parentheses: condylo-basal length 23·4 (—, 24·2, 23·1);

zygomatic breadth (14·2, 14·3, 13·6); occipital breadth 11·7 (—, 11·7, 11·1); upper molars (alveolar) 5·7 (5·6, 6·0, 5·7); lower molars 5·9 (5·7, 5·7, 6·0).

Specimens examined.—Collection of the British Museum: type and three paratypes: collector's no. 321/36; 322/36; 223/36 juv., all from type-locality.

Martino's collection, no. 1077, from Crno Polje, Prenj Mountains.

XLVII.—*The Parasites of Australian Birds and Mammals. III. Mallophaga from Sea-birds.* By GORDON B. THOMPSON.

[Plate X.]

Austrogoniodes waterstoni (Cummings). (Pl. X. figs. 3 & 4.)

Bull. ent. Res. 1914, v. pp. 173–176, fig. 8; Proc. Linn. Soc. N.S.W. 1938, lxiii. p. 113.

New records: males and females off *Eudyptula minor novæhollandiæ* (Stephens) (Little Penguin), from New South Wales, Five Is., Wollongong, 16. xii. 1937, and Tasmania, Adventure Bay, Bruny I., 25. i. 1934.

This parasite, which has been very adequately described and figured by Cummings, seems to occur commonly on the Little Penguin. As no whole figure of this species has been published, I am presenting photographs of a male and a female.

Pectinopygus (*Pectinopygus*) *bassanæ serrator* Thompson.

Ann. & Mag. Nat. Hist. ser. 11, vol. v. p. 429.

New record: males and females off *Sulita serrator serrator* (Gray) (Gannet), Tasmania, Storey's Creek, 7. iv. 1938.

This constitutes an addition to the list of Mallophaga recorded from Australian birds. I am not making any comments on this species here, as I have already dealt with it in the first part of my paper on the *Pectinopygus* group, mentioned above.

Halipeurus mirabilis, sp. n. (Pl. X. figs. 1 & 2; text-figs. 1–5.)

Type-host *.—*Puffinus pacificus chlororhynchus* Lesson (Wedge-tail Petrel).

Material examined.—♀ and ♂ types off the type-host from New South Wales, Five Islands, Wollongong, iii. 1936; 3 ♂♂, 2 ♀♀ paratypes from the same host-specimen and locality; 3 ♂♂, 4 ♀♀ paratypes off the same host-species from Wollongong, 16. xii. 1937; 2 ♀♀, 1 ♂ paratypes off the same host-species from Queensland, Masthead I.; 2 ♂♂, 1 ♀ paratypes off same host-species from San Benedicto I.

A very slender, strongly sclerotic, and deeply pigmented elongate form.

Female.

Length 4·2 mm.; greatest breadth 0·5 mm.

Head.—Slender; a little less than twice as long as broad (see text-fig. 1). The various bands of the head all clearly defined. Antennæ simple.

Thorax.—Prothorax small, narrow anteriorly, widening posteriorly, less than twice as wide as long, with heavy longitudinal marginal bands. Metathorax (see text-fig. 3) large, about one-fifth longer than wide. Legs slender but normal for the genus.

Abdomen.—A little more than four and a half times as long as broad. The first seven segments with extremely heavy, longitudinal, marginal bars, the segments all closely fused and uniformly sclerotic. Three fairly long hairs in the postero-lateral angles of each segment and a pair, one large and one shorter, to either side of the median line. Terminalia (see text-fig. 2).

Male.

Length 4·3 mm.; greatest breadth 0·6 mm.

Slightly larger, very similar to the female in general appearance.

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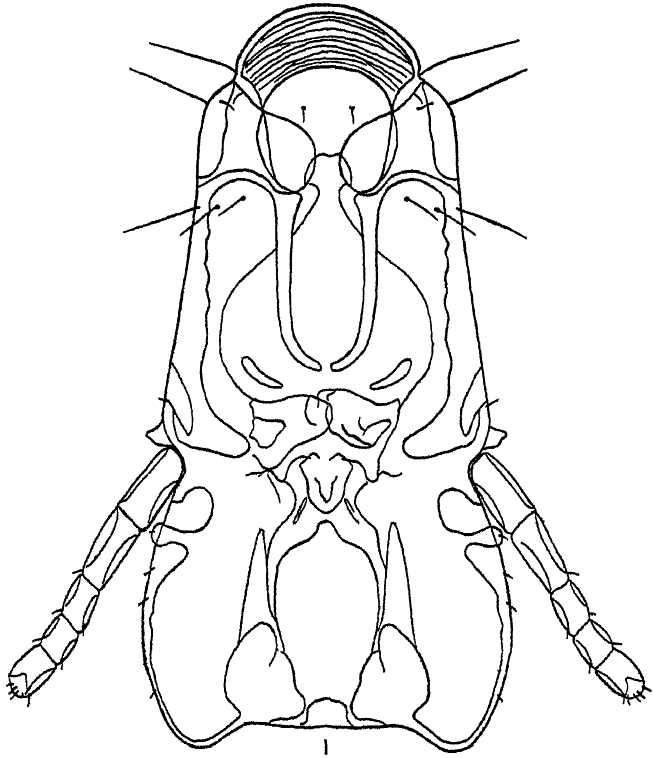
* I am following Peters (' Check List of Birds of the World ') in giving the type-host, but for the benefit of Australian students this host is called *Thyellodroma pacifica royana* (Mathews) in Mathews' ' List of the Birds of Australasia ' (1931).



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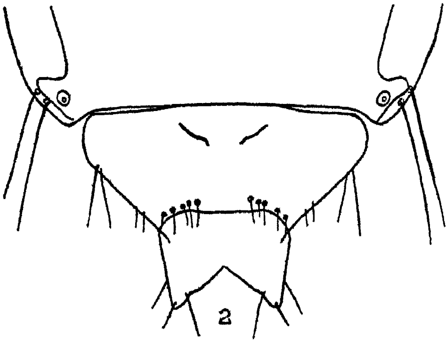


2

Fig. 1.—Head of *Halipeurus mirabilis*, sp. n., ♀.
Fig. 2.—Terminal abdominal segments of *Halipeurus mirabilis*, sp. n., ♀.

Head.—Slightly longer than in the female. Antennæ with first segment stout and elongate, the second about one-third as long; third modified, with the anterior margin longer than the posterior; the fourth and fifth small and emerging from the third postero-laterally.

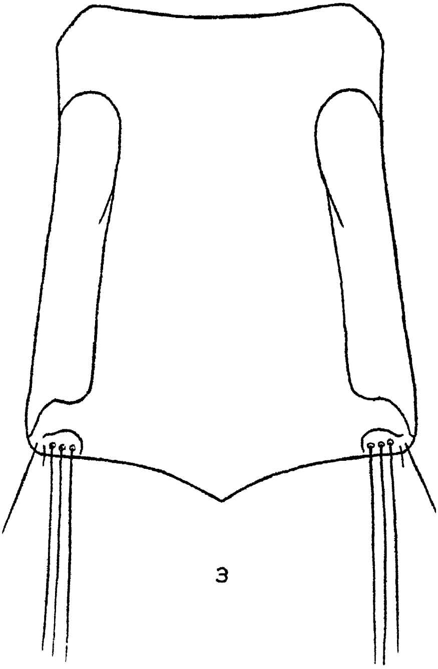
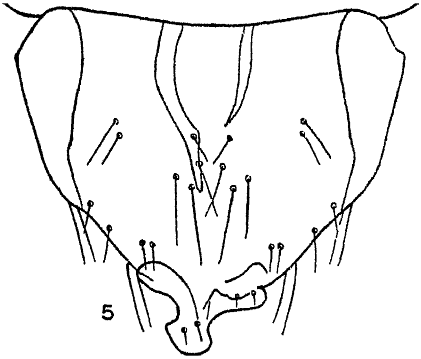


Fig. 3.—Metathorax of *Halipeurus mirabilis*, sp. n., ♀.
Fig. 4.—Male genitalia of *Halipeurus mirabilis*, sp. n.

Abdomen.—First three segments fused, posterior margin of third tergite emarginate, the fourth and succeeding segments with tergites emarginate anteriorly and posteriorly. Segments 1, 2, 3 subequal, 4 shortest, 5 short, 6 and 7 largest, subequal. The whole of the lateral margin has a heavy longitudinal band wider than in the female.

Terminalia and genitalia (see text-figs. 4 & 5).

Notes.—This new specie belongs with Piaget's *abnormis*, thus constituting a group of large species parasitic on large petrels of the genus *Puffinus*. Its distinctive feature is, however, the asymmetrical structure developed at the posterior end of the abdomen.



Terminal abdominal segments of *Halipeurus mirabilis*, sp. n., ♂.

EXPLANATION OF PLATE X.

Fig. 1. *Halipeurus mirabilis*, sp. n., ♂.
Fig. 2. *Halipeurus mirabilis*, sp. n., ♀.
Fig. 3. *Austrogoniodes waterstoni* Cummings, ♂.
Fig. 4. *Austrogoniodes waterstoni* Cummings, ♀.

XLVIII.—*Notes on the Nomenclature of Fossil Fishes.*—Part I. *Homonyms A–C.* By Errol I. White, D.Sc., British Museum (Natural History), and J. A. Moy-Thomas, M.A., Department of Zoology and Comparative Anatomy, Oxford.

These notes are offered as a contribution towards the stabilization of the nomenclature of the fossil fishes. The recent publication of the first two parts of the new 'Nomenclator Zoologicus' by Dr. S. A. Neave (Zool. Soc. London, 1939) has emphasized the fact that many of the generic names belonging to this group are preoccupied While in some instances new names are necessary, for the majority either synonyms are already available, or the names are themselves to be considered as synonyms of others already in current use; and it is chiefly to avoid the publication of numerous unnecessary new names that we consider that the matter should be taken up by those familiar with the fossils themselves and not left to nomenclatorial enthusiasts, whose methods in the past have so often done little more than add to an already overburdened synonymy.

Especially with fossils great care is necessary in dealing with nomenclature, for, owing to their imperfection, various parts of the same animal have frequently had different generic names bestowed on them, and the synonomies can be worked out reasonably well only by those who have studied the material.

To illustrate this point one need quote only the muddle regarding the nomenclature of the genus *Acanthaspis* Newberry, and of the whole group of extinct fishes of which it was the type. This genus was established by Newberry in 1875 with a single species, *A. armatus*, based on a series of isolated asymmetrical plates from the Lower Devonian of Ohio, of which the most typical bear a long spine or cornu *. These were at first tentatively referred to the Cephalaspids ; but later similar plates associated with others of a supposedly Arthrodiran nature were discovered in Europe, especially in the Rhineland and in Spitsbergen, and thus there was established an important group of Placoderms with numerous genera and species †, which received the name Acanthaspida. Unfortunately, the name *Acanthaspis* had already been used for a genus of Hemiptera (Amyot & Serville, 1834) ; but in due course our literature was doubly enriched by "*Heintzaspis*" (Strand, 1932) and "*Ohiodorulites*" (Whitley, 1933). However, if either of these authors, whose work on fossil fishes has so far escaped our notice, had been in any way familiar with the material in question, even they might have hesitated to rush in and tackle so thorny a problem. As it is, they have merely added two more to the hundreds of valueless synonyms that clog nomenclature ; for Heintz (1937, Skr. Svalb. Ishav. no. 72, p. 14) has shown that the genotype of *Acanthaspis* Newberry is not a species of "Acanthaspid" at all : indeed, it does not even belong to the Arthrodires, but is a species of the type-Macropetalichthyid, *Macropetalichthys* Norwood & Owen, 1846. The names "*Acanthaspis*" and "Acanthaspida" must disappear from our nomenclature, the former being replaced by *Macropetalichthys* Norwood & Owen, the latter, at Heintz's suggestion, by Arctolepida.

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* The type-specimen of the genotype has never, so far as we are aware, been fixed, and we therefore choose that figured by Newberry, 1875, pl. 55, fig. 1, as the lectotype.

† See Heintz, 1929, Skr. Svalb. Ishav. no. 22.

In the relatively few instances where current generic names established by living authors have needed replacement, we have considered it only ethical first to point this out to the author, in case he preferred to do this himself, but under present war-conditions this has obviously not always been possible.

Full references are cited only when new names * have been proposed: for the rest only author and date are given, as the full title may be obtained from the 'Nomenclator Zoologicus.' The references "Woodward, 1889, 1891, 1895, and, 1901" are, of course, to the four parts of the 'Catalogue of the Fossil Fishes in the British Museum (Natural History),' still the "Golden Book" of those working on the group, and here used largely as the standard reference for synonymies.

This paper, with one exception, deals only with the names of exclusively fossil genera, beginning with the letters A–C, which are later homonyms, and it includes none which has a cross-reference to an available synonym in the 'Nomenclator Zoologicus,' unless some doubtful point needs clarifying.

We propose later to publish similar notes on the homonyms beginning with the letters D–Z, and, finally, to deal with over-riding synonyms—that is to say, with current generic names which should be replaced by earlier, but less well known, ones.

We have to thank Dr. Neave and Miss Davenport for their co-operation, particularly in allowing us ready access to the files and proofs of the 'Nomenclator Zoologicus' before publication; Prof. D. M. S. Watson, F.R.S., and Prof. W. L. Bryant for allowing us to rename genera that they had described; and Mr. A. W. Exell and Mr. J. E. Dandy, of the British Museum (Natural History), for valuable advice.

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* It is, of course, understood that the genotypes remain unaltered.

Acanthopsis Agassiz, 1832, *non* Van Hasselt, 1823 (Pisces), is a synonym of *Cobitis* Linnæus, 1758, *teste* Woodward, 1901, p. 320.

Acropoma Owen, 1854, *non* Temminck & Schlegel 1843, (Pisces), was applied to an indeterminable head of a fish, *teste* Woodward, 1901, p. 481, and need not be renewed.

Aelia Costa, 1860, *non* Fabricius, 1803 (Hem.), *nec* Agassiz, 1846 (Pisces), must be replaced by *Pachylebias* Woodward, 1901. *Physocephalus* Costa, 1856, considered by D'Erasmo (1930) to be a prior synonym, is not properly determinable in our opinion.

Aellopos Münster, 1836, *non* Huebner, 1819 (Lep.), is a synonym of *Rhinobatus* Bloch & Schneider, 1801, *teste* Woodward, 1889, p. 77.

Aethalion Münster, 1842, *non* Lepeletier & Serville, 1828 (Hem.), has been replaced by *Anæthalion* White, 1938 (Ann. & Mag. Nat. Hist. (11) ii. p. 319).

Allolepis Heintz, 1932, *non* Jordan & Hubbs, 1925 (Pisces), is based on a fragment of the Arthropod *Heroldina* Broili, 1931, *teste* Gross, 1934 (Centralb. f. Min. 1934, B, p. 232).

Anogmius Cope, 1877, Bull. U.S. Geol. Surv. Territ. iii. p. 584, *non* Cope, 1871, Proc. Amer. Phil. Soc. xii. pp. 170, 354, must be replaced, since the earlier reference applies to a different fish and is, in fact, a synonym of *Pachyrhizodus* (Agassiz MS.) Dixon, 1850—see Woodward, 1901, p. 71. We therefore propose **Ananogmius,** nom. nov., for the later genus.

Aoria Jordan, 1919, Proc. Acad. Nat. Sci. Philad. lxx. 341, *non* Baly, 1863, J. Entom. London, ii. p. 149 (Col.), which replaced *Macrones* Duméril, 1856, *non* Newman, 1841 (Col.), is renamed **Macronichthys,** nom. nov.

Archæoniscus Sauvage, 1890, non Milne-Edwards, 1843 (Crust.), must be considered to be a synonym of *Amblypterus* Agassiz, 1833, at any rate until further details are known.

Arthropterus Agassiz, 1843, *non* M'Leay, 1838 (Col.), was applied to indeterminable fragments and need not be replaced.

Bidentia Musper, 1920, Jahresh. Ver. naturk. Württ. Stuttgart, lxxvi. p. 35, *non* Walcott, 1912, Smithson. Misc. Coll. lvii. p. 173 (Crust.), is renamed **Bidentulus,** nom. nov.

Brachyrhynchus van Beneden, 1871, *non* Laporte, 1832 (Hem.). *nec* Fitzinger, 1843 (Rept.), is not clearly distinguishable from the living *Istiophorus* Lacepède, 1802, *teste* Woodward, 1901, p. 497.

Centrodus M'Coy, 1848, *non* Giebel, 1848 (Pisces), is a synonym of *Megalichthys* Agassiz, 1844, *teste* Woodward, 1891, p. 378.

Ceraspis Schlueter [1888], Sitz. Ber. niederrh. Ges. Naturk. Bonn, 1887, p. 120, *non* Lepeletier & Serville, 1825, Encyc. Méth. (Ins.) x. p. 370 (Col.), is renamed **Grossaspis,** nom. nov. (after Walter Gross).

Ceratolepis Gross, 1933, Abh. preuss. geol. Landesanst. (N.F.) Heft 154, p. 16, *non* Chapuis, 1873, Mém. Soc. Sci. Liège, (2) iii. p. 260 (Col.), *nec* Sars, 1883 (Crust.), is renamed **Lepadolepis,** nom. nov.

Characodus Owen, 1867, *non* Morris & Roberts, 1862 (Pisces), is a synonym of *Rhizodus* Young, 1866, *teste* Woodward, 1891, p. 354.

Cheirodus Pander, 1858, *non* M'Coy, 1855 (Pisces), is a synonym of *Conchodus* M'Coy, 1848 (Pisces), *teste* Woodward, 1891, p. 245.

Chilodus Giebel, 1847, *non* Mueller & Troschel, 1844 (Pisces), is based on isolated teeth, and the status of the genus is doubtful—see Woodward, 1889, p. 28.

Clastes Cope, 1873, *non* Walckenaer, 1833 (Arachn.), is imperfectly differentiated from *Lepisosteus* Lacepède, 1803, but if it is later proved to be distinct, then *Clestes* Tanner, 1936 (Contr. 70, Dept. Zool. Ent. Brigham Young Univ., Utah, p. 83), may be used.

Coccocephalus Watson, 1925, Proc. Zool. Soc. London, 1925, p. 826, *non* Fieber, 1861, Eur. Hem. p. 60 (Hem.), is renamed **Cocconiscus,** nom. nov.

Coelogaster (Agassiz MS.) Eastman, 1905, Mém. Soc. géol. France, Paléont. Mém. 34, p. 12, *non* Schrank, 1780, Schr. Berlin Ges. Naturf. Freunde i. p. 303 (Hym.), is renamed **Eucoelogaster,** nom. nov.

Coelosteus Gross, 1930, Geol. palæont. Abh. Jena (N.F.), xviii. p. 152, *non* Newberry, 1887, Trans. N.Y. Acad. Sci. vi. p. 137 (Pisces), is renamed **Grossosteus,** nom. nov.

Conodus (Agassiz MS.) Woodward, 1895, *non* Gervais, 1869 (Mamm.), may be considered for the time being to be a synonym of *Caturus* Agassiz, 1834.

Corax Agassiz, 1843, Poiss. Foss. iii. p. 224, *non* Ledru, 1810, Voy. Ténériffe, ii. p. 204 (Aves), is renamed **Anacorax,**

Cryptaspis Bryant, 1934, Proc. Amer. Phil. Soc. lxxiii. p. 154, *non* Pascoe, 1872, J. Linn. Soc. London, xi. p. 476 (Col.), is renamed **Bryantaspis,** nom. nov.

Ctenopoma Heckel, 1856, Denkschr. K. Akad. Wiss. Wien, Math.-naturw. Cl. xi. (i.) p. 272, *non* Peters, 1844, Ber. Verh. K. Preuss. Akad. Wiss. 1844, p. 34 (Pisces), is renamed **Jemelkia,** nom. nov.

Cyrtaspis Bryant, 1932, Proc. Amer. Phil. Soc. lxxi. p. 241, *non* Fischer, 1853, Orthopt. Eur. pp. 198, 235 (Orth.), *nec* Stål, 1858 (Hem.), is renamed **Eucyrtaspis,** nom. nov.

XLIX.—*Vier neue* Hoplionota-*Arten* (*Col.* Cassididæ). Von Franz Spaeth, Wien.

Hoplionota kenyana, sp. n.

Ganz rötlichgelb, nur die Scheibe des Halsschildes etwas mehr rötlich und die Flügeldecken auf Scheibe und Seitendach mit pechfarbener Zeichnung.

Kurz rechteckig, im allgemeinen Halsschild und Flügeldecken von gleicher Breite, jedoch das Seitendach in der vorderen Hälfte schwach bogig erweitert, hinter der Mitte aber sehr wenig ausgerandet, an der Spitze breit abgestutzt verrundet; Körper kaum um die Hälfte länger als breit. Die Fühler reichen nicht bis an das Ende des Vorderrandes des Halsschildes und haben eine sehr dicke Keule, deren mittlere Glieder mehr als doppelt so breit als lang sind; auch das 1. und 2. Glied sind, wenn auch schwächer, verdickt, das 2. ist um die Hälfte kürzer als das 1., dagegen die folgenden (3 bis 6) ein wenig länger als das 2. und viel schlanker.

Kopfplatte breit, vor die Augen vortretend, aber vorn kaum erweitert, mit tiefem, schmalem Mitteleinschnitt. Halsschild etwa dreimal so breit wie lang, sein Vorderrand breit und tief dreieckig ausgeschnitten, daneben innen mit sehr grossen, nach aussen immer kleineren Zähnchen bis zu den Hinterecken, die ein wenig nach einwärts stehen; der Hinterrand wenig gebogen; Scheibe glänzend, bis auf zwei lange, einzeln punktierte Quereindrücke glatt.

Auf den Flügeldecken fehlen bis zur Mittelleiste Höcker; der Dorsal- und der Humeralkiel sind in dieser

34*

Strecke nur niedrige Leisten, der innere hinter der Stelle des Basalhöckers, der zweite an der Basis ganz erloschen. Der Haupthöcker ist wenig breiter als hoch; zu ihm steigen 4 Kiele auf, u.zw. jene der Dorsalreihe vorn und hinten, sowie die beiderseitigen Teile der Mittelleiste; die Suturalleiste fällt gegen die Naht, die sie nicht erreicht, sehr steil ab. Der Apikalhöcker ist nur halb so hoch wie der Haupthöcker, vierkielig. Die Mittelleiste beginnt an der Grenze des Seitendaches, verläuft schräg nach hinten, hoch und scharf zum Haupthöcker; nach hinten geht innen vom Haupthöcker und mit ihm nicht verbunden von der Pontalleiste eine anfangs hohe, dann erlöschende furca interna ab. Der Apikalhöcker wird von der Apikalleiste, die sich innen nicht ganz bis zur Naht erstreckt, geschnitten. Die Punkte auf der Scheibe sind sehr grob, innen nicht dicht gereiht; das Seitendach ist fast gleichartig punktiert.

Zeichnung: Auf dem Seitendach in der vorderen Hälfte ist mit Ausnahme eines dreieckigen Innenbasalflecks eine pechschwarze Makel, die sich auch auf die zwei letzten Zwischenräume der Scheibe erstreckt und in einem breiten, schrägen Streifen vor der gelben Pontalleiste bis an den Haupthöcker reicht; der Raum hinter der Pontalleiste ist mit Ausnahme der erhöhten Stellen und eines Flecks zwischen furca interna und Apikalleiste bis zur Dorsalreihe schwarz, welche Färbung sich etwas heller an der Umbiegung auf das Seitendach ausdehnt; von dem letzteren sind sonach nur der erwähnte Basalfleck, eine grosse Makel hinter der Pontalleiste und die Nahtspitze gelb. 5×3·5 mm.

Das einzige zur Beschreibung vorliegende Stück wurde mir vor kurzem von Sir Guy A. K. Marshall eingesendet und in Kenya: Wakuyu am 1. vii. 1937 von Mr. C. D. Knight gesammelt.

Hoplionota excelsa, sp. n.

In der Grösse, allgemeinen Körperform und der Skulptur der gleichfalls aus Sarawak stammenden *H. brookei* m. am nächsten stehend, aber mehr gerundet und daher viel breiter, Scheibe der Flügeldecken und Seitendach anders gefärbt, die ersten drei Höcker in der Dorsalreihe niedriger.

Breit-eiförmig, an der Seite gerundet, mässig gewölbt; Kopf, Fühler und Beine rotgelb, Halsschild, Schildchen und äusserer Teil des Seitendaches gelb, die Scheibe der Flügeldecken innen braunrot, der Basis- und Apikalsaum, eine Längsbinde aussen und eine Mittelbinde über der Mittelleiste, alle breit, dunkler pechbraun, endlich ein breiter Innensaum auf dem Seitendach hell feuerrot; es bleiben sonach auf der Scheibe zwei gemeinsame, grosse Querflecke braunrot; sie werden durch die Mittelbinde getrennt und reichen nach aussen bis zur Humeralrippe, der vordere bis zum Basalhöcker, der rückwärtige bis zur Apikalleiste; es sind sonach Naht, Basal- und Postbasalhöcker nebst den betreffenden Teilen der Dorsalrippe, ferner letztere zwischen der Mittel- und der Apikalleiste braunrot, die übrigen Stellen der Scheibe dunkel, pechbraun. Kopfplatte vor die Augen wenig vorgezogen, kaum erweitert, gemeinsam gerundet, ohne deutlichen Einschnitt; Kopfschild ausgehöhlt, mit einem Mittelkiel; Fühler mit dicker 4- gliederiger Keule, deren Glieder nicht ganz so lang wie dick sind; 7. Glied zum Ende erweitert und hier, aber weniger dicht als die folgenden, behaart. Halsschild über dem Kopf mit trapezförmigem Ausschnitt, gerader Basis, hier am breitesten, rechtwinkligen Hinter- und breit verrundeten Vorderecken; Scheibe mit den gewöhnlichen zwei punktierten Quereindrücken, sonst glatt; Flügeldecken mit gerader Basis; die Scheibe flach gewölbt; der Dorsalkiel ist vollständig, aber vor und nach dem Postbasal niedrig, vor dem Haupthöcker nach aussen gebogen, nach ihm wieder nach innen gerichtet, dann bis an's Ende der Scheibe fortgesetzt; der Humeralkiel hat keine Höcker, ist vorn nach aussen gebogen und trifft die Mittelleiste weit aussen vom Haupthöcker. Der Basal- und Postbasalhöcker sind niedrig, lang, der Haupthöcker kaum doppelt so hoch, breiter als hoch, vierkantig, mit einem gemeinsamen Schnittpunkt aller Kanten; der Apikalhöcker ist kaum erhöht; die Apikalleiste und die costa ultima sind vollständig, die furca interna und die costa terminalis abgekürzt; Mittel- und Apikalleiste gehen bis fast an die Naht. 7 × 6 mm.

Sarawak: Mt. Dulit, 4000 ft., Moss forest (Oxford Univ. Exped., B.M. Hobby and Moore, Holotypus im Brit. Mus.).

Bei Benützung meiner Tabelle (Wien. E. Z. 50, 1933, p. 117) würde man zur L. Z. 80 und auf *H. brookei* m. kommen.

Hoplionota pochoni, sp. n.

Kurz rechteckig, fast quadratisch, an der Seite nur kaum merklich erweitert, hinten breit gerundet; die Scheibe der Flügeldecken hell meergrün, Halsschild und Seitendach braun, die Scheibe des ersteren etwas dunkler; Kopfplatte und die ersten zwei Fühlerglieder braunrot, die übrigen Glieder bis zum 6. schwarz (die anderen fehlen dem Typus).

Die Kopfplatte ist vor die Augen vorgezogen, aber an ihrem Ende nur unbedeutend erweitert; die ersten zwei Fühlerglieder sind doppelt so dick wie die folgenden; das 3. ist halb so lang wie das zweite und vierte, die diesem folgenden zwei sind allmählich kürzer. Halsschild mehr als doppelt so breit wie lang, an der Basis, die kaum gerundet ist und innen jederseits einen grossen Basalzahn hat, am breitesten, an der Seite im Bogen verengt, vorne mit einem tiefen, trapezförmigen Ausschnitt; die Scheibe ist mehr glänzend, feiner und sparsamer, das Vordach matter, gröber und dichter punktiert. Flügeldecken flach, grob, teilweise in Streifen, die nicht ganz regelmässig sind punktiert, ohne Rippen und Querleisten; die einzige Auszeichnung ist ein kleines, dünnes, gelbes Kreuz, das an der Stelle des Haupthöckers steht und aus der Kreuzung der Dorsalrippe und der Mittelleiste als kaum herausragender Rest allein übrig geblieben ist. Seitendach mässig breit, flach abgesetzt, grob punktiert. 3·75×3·5 mm.

MADAGASCAR: Betalo.

Herr Hans Pochon in Freiburg in der Schweiz war so liebenswürdig, mir das einzige Stück zu überlassen.

Die Art ist durch den fast vollständigen Mangel der Skulptur der Flügeldecken sehr ausgezeichnet und von allen anderen Arten aus Madagascar verschieden; wollte man sie nach meiner Bestimmungstabelle (Wien. Ent. Zeit. 48, 1931, 149 ff.) bestimmen, so würde man über die Leitzahlen 1, 2, 11, 12, 13, 17, 18 auf zwei in den Zahlen 19, 20, beschriebene Arten gelangen, von andere denen sie durch das obige Merkmal und ganz Zeichnung verschieden ist.

Hoplionota sumatrana, sp. n.

Wenig gewölbt, kurz rechteckig, nicht ganz um die Hälfte länger als breit, mit der grössten Breite an der Umbiegung der Flügeldecken zur Spitze, die Decken an der Basis so breit wie der Halsschild, mit aussen nicht vorgezogener Basis, rechtwinkligen Schulterecken, nach hinten kaum merklich erweiterten, in der Mitte der Fenstermakel ganz seicht eingebuchteten Seiten, breit abgestutzt verrundeter Spitze.

Unterseite weissgelb, Kopfschild und Fühler kräftiger gelb, die Scheiben von Halsschild und Flügeldecken pechschwarz, stark glänzend, die Seitenteile des Halsschildes und das Seitendach hellbraun, je ein grösserer Fleck am Vorderrande des Halsschildes und ein kleinerer an der Basis gegenüber dem Humeralhöcker, ferner auf dem Seitendache eine grosse, am Aussenrande breitere Fenstermakel und neben der Nahtspitze ein breiter Fleck durchscheinend weissgelb.

Kopfschild mit einem gekielten, lanzettförmigen Eindruck, die Kopfplatte vorn gerundet und weit vor die Augen vortretend, aber nicht erweitert, in der Mitte mit einem schmalen, hinten durchbrochenen Einschnitt.

Halsschild quer-rechteckig, dreimal so breit wie lang, an der Seite nicht viel kürzer als in der Mittellinie, über dem Kopf tief trapezförmig ausgeschnitten, die Seiten rechtwinklig und fast senkrecht zur Basis, halb so lang wie der Vorderrand, zwischen ihnen und dem Ausschnitt fein gezähnelt, der Hinterrand bis zu einem sehr kleinen Basalzähnchen gerade, dann sehr wenig vorgezogen; die Scheibe glatt, stark glänzend, mit je einem schrägen Eindruck neben der Mitte und einem tief punktierten, schmalen Quer-Eindruck in der Mitte vor der Basis; die Seitenflügel mit sehr groben Punktgruben, niedriger gelegen als die gewölbte Scheibe.

Flügeldecken wenig gewölbt, mit groben, im allgemeinen regelmässigen Punktstreifen. Die Dorsalrippe kräftig, mit einem langen Basalhöcker, dahinter in eine Grube abfallend, dann in einen langgestreckten, sehr niedrigen Postbasalhöcker erhoben, hierauf wieder, aber schwächer gesenkt, dann aufsteigend in einen scharfkantigen, mehr als doppelt so hohen wie breiten Haupthöcker, in dem sich die Dorsalrippe und die Mittelleiste in *einem* Punkte schneiden, dahinter zuerst tief abfallend, dann in einen im Verhältnis zum Haupthöcker halb so hohen, ebenfalls scharfkantigen Apikalhöcker aufsteigend, schliesslich im Postapikal endend.—Der Humeralkiel beginnt in einem ziemlich hohen Humeralhöcker, ist dann stark nach innen gekrümmt bis zur Pontalleiste, wo er erlischt, sehr niedrig. Die Pontalleiste steigt von der Seitendachbrücke etwas nach hinten gerichtet auf den Haupthöcker und stürzt dann als kurze Suturalleiste bis zur zweiten Punktreihe ab ; ebenso geht die Apikalleiste über die Dorsalrippe nach innen ; sie ist aussen nach vorn gebogen, mit der neben dem Haupthöcker beginnenden furca interna nicht verbunden ; die costa terminalis ist mit der Apikalleiste verbunden, nicht aber die eine isolierte Beule bildende costa ultima. (Ueber Lage und Bezeichnung aller dieser Erhöhungen auf den Flügeldecken siehe Spaeth, Wiener Ent. Zeitg. 48, 1931, S. 149.) Seitendach bis zur Spitze wenig verschmälert, mit groben Punkten, die hinten stellenweise zwischen Querrinnen stehen.

H. sumatrana ist der *jacobsoni* m. aus Java zunächst verwandt und ähnlich, von gleicher Körperform und Grösse, ähnlicher Skulptur der Flügeldecken, aber die Farbe der Scheiben des Halsschildes und der Flügeldecken ist viel dunkler, pechschwarz, (bei *jac.* rostrot), die Rippen und Leisten haben dieselbe Farbe wie die übrige Scheibe (bei *jac.* sind sie viel dunkler, schwärzlich), die hellen Zeichnungen auf Halsschild und Seitendach sind heller gelb als bei *jac.*, bei der sie sich von der sonstigen Färbung wenig abheben, das Schildchen ist gelb, (bei *jac.* rostrot), alle Erhöhungen der Flügeldecken sind viel höher, besonders Haupt- und Apikalhöcker doppelt so hoch wie bei *jac.*, schärfer gekantet, der Humeralhöcker ist bei *jac.* kaum angedeutet, die Pontalleiste weniger nach hinten gezogen. 5 × 4 mm.

Ostküste von SUMATRA : Asahan, Goenoeng, Malajoe. 50–60 m. Von Herrn F. Schneider, Zürich, in einer Gambirpflanzung 1934–36 gesammelt. Das Imp. Inst. of Ent. hat zwei Stücke eingesandt. Einer der Typi wurde mir freundlichst überlassen.

L.—*Hydracarina of Algeria.*

By Dr. C. Walter, Riehen, Basel.

The little collection of Hydracarina described below contains water-mites taken in North Africa (partly in saline waters) by Mr. L. C. Beadle, and submitted to me for examination through the kindness of Mr. R. J. Whittick of the British Museum (Natural History), London.

The water-mites of North Africa, consisting of some ninety species, are better known than those of most parts of the African continent. Nevertheless, every collection, even the smallest, may contain forms of interest and contribute to our knowledge of this group of animals. In order to avoid water-mites becoming shrunken and too hard and to facilitate study and microscopical preparation, they should be preserved in a fluid consisting of 10 vols. glycerine, 9 vols. water, and 1 vol. glacial acetic acid.

The Hydracarina in this collection were obtained from five localities, four of which are situated in the Biskra desert and one at the Mediterranean coast:—

1. Desert, Biskra.
   (*a*) Stagnant channel near west shore of Meggarine north lake, 15 km. north of Touhhouert. Density of the water 1007. 16. ii. 38.
      Eylais megalostoma Koen. 2 ♀ ovig.
   (*b*) Stagnant channel north of (*a*). Density of the water 1017. 16. ii. 38.
      Eupatra semiperforata Walter. 4 ♂, 1 ♀.
   (*c*) Well within depression 33, 10 mts. from edge of water. Density of the water 1007. 21. ii. 38.
      Arrenurus pervius, sp. n. 1 ♂, 3 ♀.
      Oribatidæ.
   (*d*) Swamp due to overflow from artesian system between El Bordj and Ain Zerga. 9. iii. 38.
      Eylais megalostoma Koen. 1 ♂, 1 ♀ ovig.

2. North coast within 150 km. of Algiers. Ponds in Forêt de la Réghaia. Fresh water. 25. iii. 38.
   Eylais tantilla Koen. 2 ♀ ovig.

Hydryphantes placationis Thon. 1 ♀ ovig.
Acercus ornatus (Koch). 7 ♀ ovig.

Of these species, *Eupatra semiperforata* Walter has been recorded only from North Africa, while *Eylais megalostoma* Koen. occurs in widely separated parts of the African continent. The species taken in the ponds of the Forêt de la Réghaia, namely, *Eylais tantilla* Koen., *Hydryphantes placationis* Thon, and *Acercus ornatus* (Koch), are widely distributed, not only in North Africa, but also in Europe and Asia.

Eylais megalostoma Koen. and *Arrenurus pervius*, sp. n., were collected in waters with a density of 1007, and *Eupatra semiperforata* Walter in 1017 (density of pure water 1000, of sea water 1022). These species are, therefore, to be added to the list of those adapted to conditions of salinity.

DESCRIPTION OF THE NEW SPECIES.

Arrenurus pervius, sp. n. (Figs. 1–4.)

Male.

Length of body 0·9 mm., breadth 0·75 mm.

The anterior margin of the body, strongly slanting towards the sides, is nearly straight between the antenniform bristles, which are 225 μ apart. Sides of the body are almost straight and parallel. The appendix, very indistinctly separate from the body and strongly tapered posteriorly, measures 120 μ at its posterior end. Eyes 85 μ apart, somewhat distant from frontal margin. Colour brownish, excretory organ light yellow.

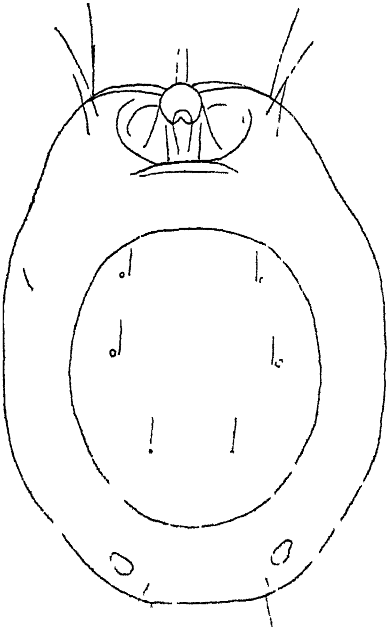
Dorsal plate more or less oval in outline, measuring 185 μ in length, 105 μ in breadth. Dorsal surface of body without any humps.

Dorsal part of appendix falling off very steeply, bearing in its middle portion a deep concavity with strengthened anterior margin and membranous arched sides. A translucent tube of conical shape is projected backwards; its length is 125 μ and its basal breadth 150 μ, the diameter of the terminal opening, supplied with a little tooth in the middle of the dorsal margin, is 75 μ. The tube, surpassed by the rounded edge of the small blade-like petiolus, is in direct communication with a deep longitudinal groove of the ventral surface of appendix. This groove is closed posteriorly by the ends bending inwards till they nearly meet, forming a more or less distinct fissure. Length of the groove 410 μ, breadth 75 μ. It bears in its less deepened anterior portion the genital opening and behind it the excretory pore. There is a pair of bristles above and a pair of fine setæ below the tube of petiolus.

Length of palpal segments along the extensor margin s as follows:

I. = 45 μ, II. = 80 μ, III. = 70 μ, IV. = 110 μ, V. = 55 μ.

Fig. 1.



Arrenurus pervius, sp. n. Dorsal view of the male.

On its inner side the second segment has one strong and three weaker bristles, all feathered. The distal edge of the flexor side is angular and distinctly extended anteriorly.

The epimera cover about half of the ventral surface, but do not reach the frontal margin of the body. The median edges of the third and the fourth epimera are

Fig. 2.

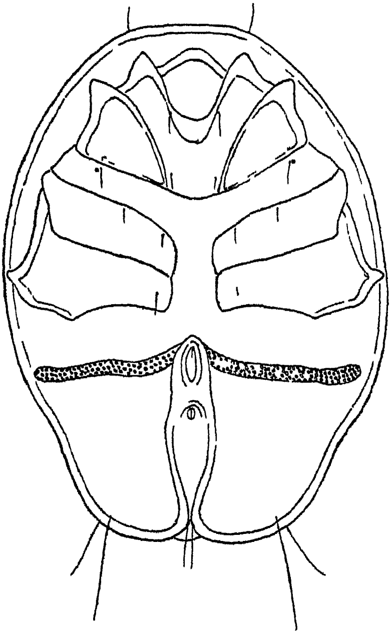
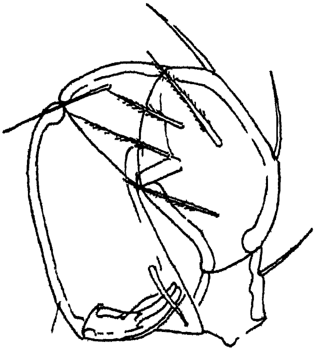


Fig. 3.



Arrenurus pervius, sp. n.

Fig. 2.—Ventral view of the male.
Fig. 3.—Palp of the male.

of equal length. Posterior groups separated by a distance of 75 μ. Inner portion of the posterior margin of the fourth epimera slightly incurved, outer portion sloped obliquely backwards.

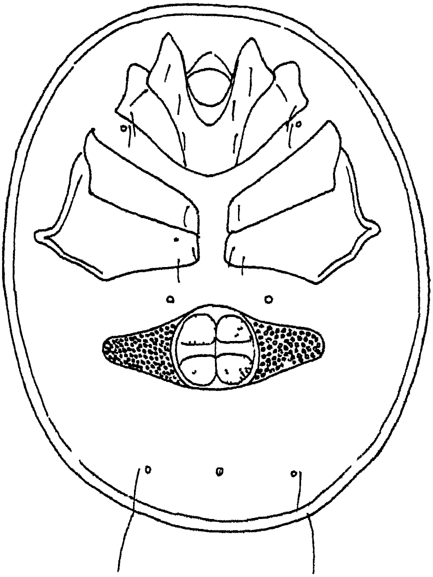
Length of the legs :

I. =675 μ, II. =925 μ, III. =865 μ, IV. =1000 μ.

Spur on the distal end of the fourth segments of legs IV. with about eight bristles of medium length.

Genital area lying at the junction of body and appendix. The plates are very long and narrow (30 μ). Inner portion, fixed at the anterior half of genital opening, sloped obliquely backwards, outer transverse portion extending outwards to the sides of the body.

Fig. 4.



Arrenurus pervius, sp. n. Ventral view of the female.

Female.

The body is oval, regularly rounded, without well-marked emarginations.

Length 1·140, breadth 0·945 mm.

The dorsal plate is nearly elliptical, slightly flattened in its posterior portion, measuring 960 μ in length and 720 μ in breadth. It is separated from the frontal margin by a distance of 150 μ. Colour as in male.

Length of the segments of the palps:

I. = 45 μ, II. = 95 μ, III. = 75 μ, IV. = 110 μ, V. = 55 μ.

They are slightly longer than in the other sex, but conform in shape and in the number of bristles.

About the anterior half of the ventral surface is covered by the epimera (length 525, breadth 750 μ); they do not reach the front of the body. Inner margin of epimera 3 and 4 of same length. The two groups formed by these epimera 55 μ apart. Postepimeral pore equally distant from epimera and genital area.

Genital area lying about 70 μ from epimera. The lips together are broader than long (180 : 155 μ). Each lip bears two large chitinous spots. Genital plates short, 150 μ, lying transversely and decreasing laterally. Lateral extension of the whole area about 500 μ.

Excretory pore about 110 μ from posterior margin of body.

Locality.—Desert Biskra. Well within depression 33, 10 mts. from edge of water. Density of the water 1007. 21. ii. 38. 1 ♂, 3 ♀.

LI.—*Notes on the Plectognath Fishes.*—III. *On* Monacanthus setifer *Bennett and related Species, with a Key to the Genus* Stephanolepis *and Descriptions of Four new Species.* By A. Fraser-Brunner.

The genus *Stephanolepis* was proposed by Gill in 1861, with *Monacanthus setifer* Bennett as its genotype. Günther (Cat. Fish. Brit. Mus. 1870) considered *Stephanolepis* to be a synonym of *Monacanthus*, and under the name *M. setifer* included nearly all the species dealt with in this paper.

Since that time, the general practice has been to regard *Stephanolepis* either as a good genus, or as a subgenus of *Monacanthus*, and to include in it many forms which the present author consigns to other genera. All the New World forms included here have been considered to represent two species, *Stephanolepis hispidus* (Linnæus) and *S. oppositus* (Poey); the Japanese *S. cirrhifer* (Schlegel) has been regarded as distinct, and all the rest have been relegated indiscriminately to *S. setifer*, which has been referred to more than once as an "East Indian" species.

In view of this, I have tried to ascertain what it actually was that Bennett described under the name which was later to become so ubiquitous. Unfortunately, his type does not appear to be still in existence, but an examination of his original description is interesting *.

Firstly, there are no grounds whatever for the assumption that it was an East Indian species. It was part of a collection made by H.M.S. 'Chanticleer,' and no locality was given for it; but its description follows immediately on that of *Chromis tænia* from Trinidad, and if any inference is to be drawn at all it is that Bennett intended it to be understood that his *Monacanthus setifer* was from the same place †.

Moreover, the voyage made by the 'Chanticleer' (1828–30) was confined to the Southern Atlantic Ocean, the route being as follows:—Portsmouth, England, *via* Fernando Noronha to Rio de Janeiro; south to Cape Horn; eastward to Cape of Good Hope; thence *via* St. Helena and Ascension to Para, Trinidad, Panama, Jamaica, Cuba, Bermuda, and back to Portsmouth ‡.

Bennett's account of *Monacanthus setifer* is as follows:—

"Mon. cauda hispida: cirris brevibus multifidis raris conspersus: pinnæ dorsalis radio 2do longissimo; pallida brunneus; lateribus mediis nigra undulatum longitudinaliter lineatus; pinnae caudalis rotundatae fascia angusta submedia. D. 1,28. A. 29. C. 12. P. 12."

Reference to the accompanying key will show that this description can apply to only two of the forms included there, and in view of the suggestion of a West Indian locality I feel convinced that the second one, to which

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* Comm. Proc. Zool. Soc. London, 1830, p. 112.

† "Start Bay, on South coast of Devon," is given by Fowler (1936, Bull. Am. Mus. Nat. Hist. lxx. pt. 2, p. 1095), who has misread the original paper. This locality applies to *Sciæna aquila*, mention of which followed the account of *M. setifer*.

‡ Webster, W. H. B., 1834, Narrative of Voy. 'Chanticleer,' 2 vols., frontispiece.

I have applied the name, is the one Bennett described. It was later rediscovered by Poey as *Monacanthus oppositus*.

The genus *Stephanolepis* when considered distinct, has usually been differentiated from *Monacanthus* merely on account of the smaller development of the ventral flap. I find, however, that it differs in other respects, particularly in the absence of caudal bucklers and the form of the scales—the latter being the character on which Gill based his genus and its name. It belongs to the group of Monacanthidæ (or Aluteridæ), having a movable pelvic spine, and is distinguished by the following combination of characters :—

Dorsal spine behind middle of eye, with barbs more or less developed on posterior edges only. Gill below hind margin of eye. Pelvic spine present, movable, short, and broad ; ventral flap little developed, not extending beyond pelvic spine. Scales arranged in transverse series, each with a pedicle supporting a number of radiating spinules or an expansion bearing spinules. Dermal filaments sparsely developed, very small. Caudal bristles developed in both sexes ; no caudal spines.

The genus is represented on the Atlantic coasts of America, but not on the Pacific side ; on all African coasts, but not on those of India (Day included "*Monacanthus setifer*" in his 'Fishes of India' apparently on hearsay) ; on the coasts of China and Japan, but not in the East Indies or Australia.

As in most Plectognaths, sexual dimorphism is discernible, females having a slightly deeper body and the caudal fin more rounded than males, but it is less noticeable in these fishes than in some of the other genera. The presence of dermal filaments and the elongation of one or more dorsal rays do not seem to have any sexual significance.

Although during life these fishes are known to change colour under emotional stress by means of expansion or contraction of chromatophores in greater or lesser degree, when preserved in spirits the actual distribution of these chromatophores is usually apparent and proves a usual taxonomic character. Many of the other characters which serve to distinguish these species are measurements used to express differences in facies which are easy to see on comparison, but difficult to define.

The *length* is measured from tip of snout to base of middle caudal rays; *depth*, between origins of soft dorsal and anal fin; *head*, from tip of snout to upper end of gill-opening; *interdorsal space* from immediately behind base of first dorsal spine (irrespective of membrane, which is often broken) to base of first soft dorsal ray; *caudal peduncle* from base of last anal ray to base of lowermost caudal ray.

Descriptions of scales apply to those on middle of side of fish, just behind end of pectoral fin. The length of the dorsal spine is found to be constant for each species within certain limits of variation, and the soft dorsal and anal fin-counts are found generally to be not so variable as usually supposed; in most cases there is a normal count, with occasional variation of 1 ray.

Unless otherwise stated, descriptions apply to adult specimens, and wherever possible comparisons have been made between specimens of the same size.

Key to the Species of Stephanolepis.

I. Pattern distinctly longitudinal, consisting of short dark bars, lozenge-shaped patches, or complete bands on side. Scales transversely elongate, with keel-like pedicle supporting a spinate, lozenge-shaped expansion.

  A. Dorsal and anal rays 26–28. Pectoral 12. Dorsal profile of head straight, making a very slight angle with that of interdorsal space.

    1. 3 complete bands along side; caudal with a median broad band and four narrow marginal bands. Bristles confined to caudal peduncle, which is contained three times in length of head. East Africa .... 1. *freycineti*.

    2. Numerous short bars on side, forming many interrupted longitudinal bands; caudal with two broad transverse bands. Bristles extending forward to below middle of soft dorsal fin; caudal peduncle contained twice in length of head. Caribbean Sea .... 2. *setifer*.

  B. Dorsal and anal rays 30 or more. Profile of head making a distinct angle with that of interdorsal space.

    1. Profile of snout straight. Pattern consisting of numerous short dark horizontal bars or streaks, specially prominent in young. Bristles confined to caudal peduncle. Dorsal rays 33 (32–34); pectoral 14. China and Japan .... 3. *cirrhifer*.

2. Profile of snout concave. Pattern consisting of roughly oblong or lozenge-shaped dark patches placed horizontally; dark stripes radiating downward from eye across cheek. Bristles extending forward beyond caudal peduncle.

a. Dorsal spine stout, with strong barbs posteriorly. Dorsal and anal rays 32-33. Pectoral 14. Depth of body contained not more than twice in length. Length of caudal peduncle contained 3-3½ times in length of head. Caudal bristles extending forward to below middle of dorsal fin.

i. Head contained 3⅓ to 3½ times in the length, eye 3½–4 times in length of head. Dorsal spine contained 1⅓ to 1⅔ times in length of head. Gill-opening not greater than diameter of eye. Coast of Brazil. 4. *insignis.*

ii. Head contained 3–3⅓ times in the length, eye 4–4½ times in length of head. Dorsal spine contained 1¾–3 times in length of head. Gill-opening greater than diameter of eye. Persian Gulf.... 5. *diaspros.*

b. Dorsal spine slender, without strong barbs (in adults), its length contained 1½ times in that of head. Dorsal and anal rays 30. Depth of body contained 2½ times in the length. Length of caudal peduncle contained 2–2½ times in length of head. Caudal bristles extending forward to below origin of soft dorsal or beyond. Pectoral 13. Levant, through Suez Canal to Red Sea .... 6. *ocheticus.*

II. Pattern vaguely mottled or distinctly transverse.

A. Dorsal and anal rays more than 30.

1. Scales broad with keel-like pedicle supporting a rhombic expansion which bears rows of spinules, the posterior of which are long and pointed backward.

a. Profile of snout straight, scarcely making an angle with that of interdorsal space. Length of caudal peduncle contained 4 times in that of head, head 3 times in length of fish. Dorsal spine much shorter than interdorsal space. Scales comparatively large. Dorsal and anal rays 31. Pectoral 13. East Africa .... 7. *rectifrons.*

b. Profile of snout concave, making a distinct angle with that of interdorsal space. Length of caudal peduncle contained 3 times in that of head, head 3¼ to 3⅓ times in that of fish.

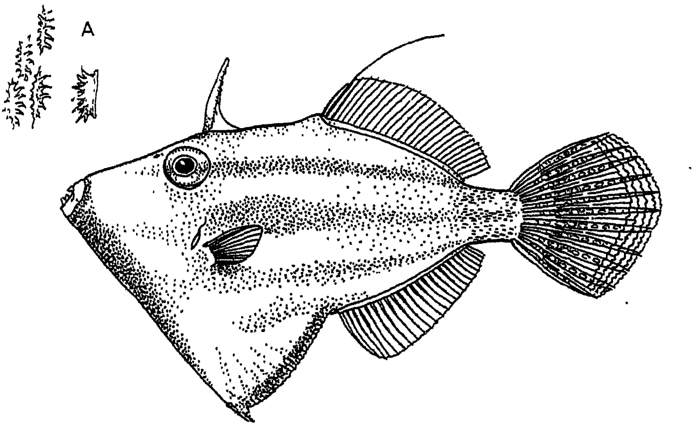
i. Dorsal spine much shorter than interdorsal space. Dorsal and anal rays 32–33. Pectoral 14. South Africa...... 8. *auratus.*

ii. Dorsal spine as long as interdorsal space. Dorsal and anal rays 31. Pectoral 13. Atlantic .... 9. *varius.*

2. Scales small, with constricted pedicle bearing a number of equal radiating spinules.
  - *a.* Profile of snout straight. Supra-orbital width not greater than diameter of eye. Dorsal spine with 6 or 7 strong barbs. Dorsal and anal rays 31–34. Pectoral 13. N. Atlantic .... 10. *hispidus.*
  - *b.* Profile of snout concave. Supra-orbital width greater than diameter of eye. Dorsal spine with 12 or more small barbs. Dorsal and anal rays 32. Pectoral 13. Gulf of Mexico .... 11. *spilonotus.*

B. Dorsal and anal rays 27–28. Scales comparatively large and coarse. Profile of snout slightly concave. Pectoral 10. Japan ...... 12. *japonicus.*

Fig. 1.



Stephanolepis freycineti. × 1⅖. A, scales.

Stephanolepis freycineti.

Balistes freycineti Quoy and Gaimard, 1824, Voy. 'Uranie,' Paris, p. 213 (part).

Monacanthus freycineti Hollard, 1854, Ann. Sci. Nat. Paris, (4) ii. p. 336 (part); Sauvage, 1891, Hist. Nat. Madagascar, Poiss. xvi. p. 509 (part).

Monacanthus setifer Regan, 1908, Trans. Linn. Soc. London, xii. pt. 3, Zool. p. 252 (not of Bennett).

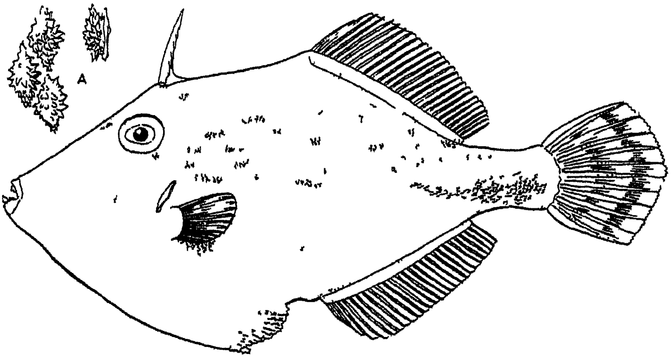
Dorsal profile of head, from tip of snout to base of first dorsal spine, straight, scarcely making an angle with that of interdorsal space. Depth of body between origins of soft dorsal and anal fins contained 2⅖ times in length of fish; length of head 3⅓ times. Diameter of eye contained 3 times in length of head, greater than interorbital space. Distance from upper edge of orbit to base of first dorsal spine about half diameter of eye. Length of snout contained $4\frac{3}{4}$ times in length of fish, shorter than interdorsal space, which is contained 4 times. Width of gill-opening less than diameter of eye. Caudal peduncle $\frac{1}{3}$ length of head. First dorsal spine straight, stout, with about 6 strong barbs on each posterior edge, its length contained $1\frac{1}{2}$ times in interdorsal space, twice in length of head, 6 times in length of fish. Soft dorsal fin with 28 rays, the second ray filamentous; anal fin with 26 rays; pectoral with 12. Scales small, transversely elongate, each with a keel-like pedicle supporting a narrow, lozenge-shaped expansion which bears at least two rows of sub-equal spinules. A patch of bristles on side of tail, scarcely reaching forward beyond caudal peduncle.

Pale brown, with 3 broad longitudinal dark bands, the uppermost from eye to end of soft dorsal, the second from above gill-opening to base of caudal fin, the third from below pectoral to end of anal fin; a narrow area. from mouth to pelvic shield, blackish. Caudal fin with a broad median band, and four narrow sub-marginal bands; overlying these are numerous spots of bright carmine forming a regular pattern. Other fins without marking.

Hab. Mauritius; Madagascar; Seychelles.

Quoy and Gaimard, working on the material of a world cruise, appear to have confused two species having a general resemblance in form and pattern, one from Mauritius, which locality they quote, the other from Australia. In sonsequence their description is composite. envisaging a fish with 38 dorsal rays, antrorse spines on the caudal peduncle, and a movable pelvic spine. Subsequently, Hollard repeated this description and figured what is obviously the Australian form with a fixed spine, and his lead was followed by Sauvage who gave an even more faithful reproduction of the Australian species. In consequence, the name *freycineti* was for a long time applied by Australian authors to this rather common New South Wales species, and it is only recently that Whitley has drawn attention to the error, designated the name to a fish with movable pelvic spine from Mauritius and Madagascar, and described the Australian form as *Meuschenia skottowei.* In the British Museum collection I now find the fish described and figured above, and believe it fairly certain that this represents the species to which the name *freycineti* should be applied following Whitley's designation. It is 45 mm. in length, collected at the Seychelles. In general form and pattern it bears a striking resemblance to young or half-grown specimens of *Meuschenia skottowei* Whitley, but differs in numerous respects on closer examination, notably, of course, in the presence of the pelvic spine, the absence of caudal bucklers, and the lower number of dorsal and anal rays.

Fig. 2.



Stephanolepis setifer. × $\frac{5}{8}$. A, scales.

Stephanolepis setifer.

Monacanthus setifer Bennett, 1830, Comm. Proc. Zool. Soc. London, p. 112.

Monacanthus oppositus Poey, 1861, Memorias, ii. p. 331; Jordan & Evermann, 1898, Bull. U.S. Nat. Mus. xlvii. p. 1716; Meek & Hildebrand, 1928, Field Mus. Pub., Zool. xv. no. 249, p. 798; Beebe & Tee Van, 1928, 'Zoologica,' x. no. 1, p. 258, fig.

Dorsal profile, from tip of snout to origin of first dorsal spine, straight, making a slight angle with that of interdorsal space. Depth of body contained 2⅓ times in the length; length of head 3½ times. Diameter of eye contained 3¾ times in length of head, greater than interorbital space. Distance from upper edge of orbit to base of first dorsal spine less than diameter of eye. Length of snout contained 4¾ times in length of fish, less than interdorsal space, which is contained 4⅓ times. Width of gill-opening less than diameter of eye. Caudal peduncle half as long as head. First dorsal spine half length of head, stout, with about 6 strong retrorse barbs on each posterior edge. Soft dorsal fin with 27–28 rays; anal fin with 26–27, pectoral with 12 rays. Scales small, rhombic, each with a keel-like pedicle supporting a rhombic expansion which is irregularly spinate. A patch of bristles on side of tail, anteriorly tapering to a point below posterior third to dorsal fin.

Pale yellowish brown, with numerous longitudinal dark patches and streaks on side; head and ventral flap profusely spotted with dark brown; two dark bands across caudal fin.

Hab. Caribbean Sea.

Described above from a specimen 116 mm. long, from Cuba, received on loan from the Museum of Comparative Zoology, Harvard, Mass., which agrees very well with Poey's description of *M. oppositus* and is about the same size as his type-specimen; and two other specimens in the collection of the British Museum (Nat. Hist.), one 84 mm. long from Cartagena, U.S. of Columbia, the other 88 mm. long, without locality. Meek and Hildebrand recorded this species (as *M. oppositus*) as common at Colon, Panama; they give the dorsal and anal fin-counts as 27–29.

Stephanolepis cirrhifer.

Monacanthus cirrhifer Schlegel, 1850, Fauna Japon., Poiss. p. 290, pl. cxxx. fig. 1; Bleeker 1858, Act. Soc. Sci. Indo-Nederl. iii. Japan, iv. p. 31; Steindachner, 1898, Reise Aurora, Fische, p. 223; Jordan & Snyder, 1901, Check List Fish. Japan, p. 93; Jordan, Tahaka, & Snyder, 1913, Cat. Fish. Japan, Journ. Coll. Sci., Imp. Univ. Tokyo, xxxiii. 1, p. 217; Fukui, 1923, Folia Anat. Japon Tokyo, i. p. 345.

Monacanthus komuki Bleeker, 1853, Verh. Ak. Vet. i. p. 13, fig. 1; Act. Soc. Sci. Indo-Nederl. iii. Japan, iv. p. 31.

Monacanthus setifer Günther, 1870, Cat. Fish. Brit. Mus. viii. p. 239 (part); 1880, 'Challenger' Rep., Shore Fishes, pp. 3, 74 (part); Mystrom, 1887, Sven. Vet. Handl. p. 47; Ishikawa, 1897, Prelim. Cat. Fish. Jap. p. 3; Seale, 1914, Fish Hongkong, Philippine Journ. Sci. ix. no. 1, D, p. 73; Fowler, 1931, Hong Kong Nat. ii. p. 313, fig. 14.

Stephanolepis cirrhifer Jordan & Fowler, 1902, Proc. U.S. Nat. Mus. xxv. p. 264.

Hab. Coasts of China and Japan.

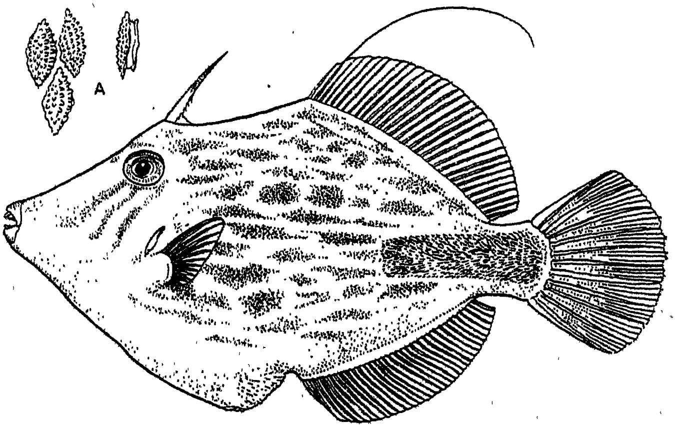
I have examined a number of examples of this species, from various parts of Japan and North China, varying in length from 30 to 215 mm.

Stephanolepis insignis, sp. n.

Monacanthus setifer Günther, 1870, Cat. Fish. Brit. Mus. viii. p. 239 (part). Not of Bennett.
Monachus hispidus Jordan & Evermann, 1898, Bull. U.S. Nat. Mus. xlvii. p. 1715 (part).

Dorsal profile of snout concave, making an angle with that of the forehead, which in turn makes a distinct obtuse angle with that of the interdorsal space. Depth of body between origins of soft dorsal and anal fins contained 1⅔ to 2 times in the length. Length of head contained 3⅓ to 3½ times in length of fish. Diameter of eye contained 3½ to 4 times in length of head, equal to interorbital space. Distance from upper edge of orbit to base of first dorsal spine less than diameter of eye. Length of snout contained 4⅔ times in length of fish, shorter than interdorsal space, which is contained 4⅓ times. Width of gill-opening equal to diameter of eye, or rather less. Length of caudal peduncle contained 3 times in length of head.

Fig. 3.



Stephanolepis insignis. Holotype. × $\frac{5}{12}$. A, scales.

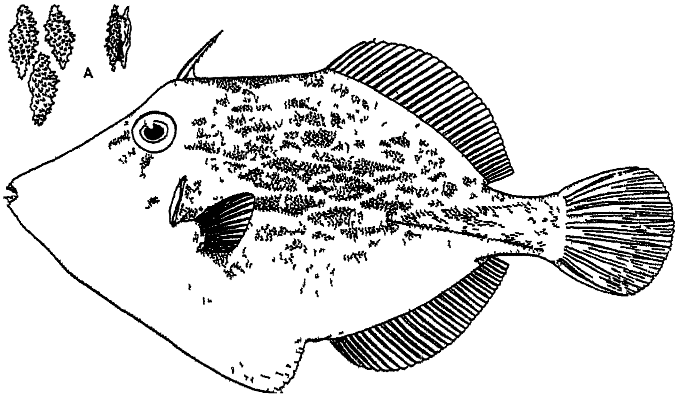
First dorsal spine strong, with 4 or 5 strong barbs basally on posterior edges, its length contained 1⅓ to 1⅔ times in that of head, 1½ times in interorbital space, 6½ times in length of fish. Soft dorsal fin with 32–33 rays, the second ray usually filamentous, the 12th being the longest of the remainder. Anal fin with 32–33 rays; pectoral with 14. Scales small, vertically elongate, lozenge-shaped, each with about 3 rows of feeble spinules borne on the expanded crest of a keel-like pedicle. A patch of bristles, truncate anteriorly, extending forward from caudal peduncle to below middle of soft dorsal fin.

Pale brownish or greyish, with 3 or 4 radiating lines downward and forward from eye across cheek; a distinct pattern on side composed of dark oblong or lozenge-shaped longitudinal patches on a paler ground.

Hab. Coast of Brazil.

The holotype is a specimen 185 mm. long, from Sacco Sao Francisca, Rio de Janeiro, in the British Museum (Nat. Hist.). In addition I have examined six other specimens from Rio de Janeiro, also in the national collection, and two received on loan from the Museum of Comparative Zoology, Harvard, U.S.A., one of which is from Bahia.

Fig. 4.



Stephanolepis diaspros. Holotype. × ⅞. A, scales.

Stephanolepis diaspros, sp. n.

Monacanthus setifer Gunther, 1870, Cat. Fish. Brit. Mus. viii. p. 239 (part); Day, 1878, Fishes of India, p. 692 (part). Not of Bennett.

Very similar to *S. insignis*, but :—

Length of head contained 3–3⅛ times in length of fish.
Diameter of eye contained 4 to 4⅓ times in length of head,

length of caudal peduncle $3\frac{1}{2}$ times. Dorsal spine slightly curved, stout, with 6 or 7 retrorse barbs distally on each posterior edge, its length contained 2 to $2\frac{2}{3}$ times in interdorsal space, 2 to 3 times in length of head. Width of gill-opening greater than diameter of eye. Soft dorsal and anal rays 32 , pectoral with 14 rays.

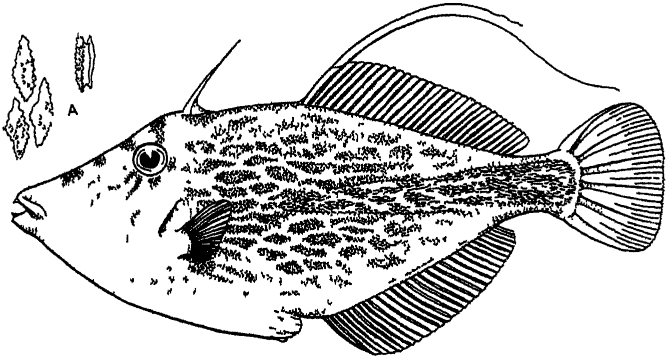
Length of snout contained $4\frac{1}{3}$ times in the length of the male fish, $4\frac{1}{2}$ times in that of the female. Posterior margin of caudal fin angulate in male, rounded in female.

Pattern on side having effect of pale lines dividing a dark ground into roughly lozenge-shaped zones.

Hab. Persian Gulf.

The holotype is 220 mm long, a female, one of 4 from Muscat, the smallest being 115 mm. in length. I have also examined 2 others, 68–78 mm long, from Jask, and 1 (93 mm.) from near Dabai All are preserved in the British Museum (Nat. Hist).

Fig. 5.



Stephanolepis ocheticus Holotype. × $\frac{3}{5}$. A, scales.

Stephanolepis ocheticus, sp. n.

Monacanthus setifer Tillier, 1901, Mem Soc Zool. France, xiv. pp. 292, 297, 299; Norman, 1927, Trans Zool. Soc. xxii. pt. 3, p. 381. Not of Bennett.

? *Monacanthus cirrhifer* Steindachner, 1902, Fische Sud-arab und Sokotra, p. 37.

Dorsal profile of snout concave, making a very slight angle with that of interdorsal space. Depth of body between origins of soft dorsal and anal fins contained 2½ times in the length, length of head 3½ times. Diameter of eye contained 4–4½ times in length of head, equal to, or greater than, interorbital space. Distance from upper edge of orbit to base of first dorsal spine less than diameter of eye. Length of snout contained 4⅘ times in length of fish, equal to interdorsal space. Width of gill-opening equal to, or less than, diameter of eye. Length of caudal peduncle contained 2½ times in length of head. First dorsal spine slender, without strong barbs (4 or 5 small ones present in young specimens), its length contained 1⅓ times in interdorsal space, 1⅔ in head, 6½ times in length of fish. Soft dorsal fin with 30–31 rays, the first and second usually filamentous ; anal with 30–31 rays ; pectoral with 13. Scales small, vertically elongate, lozenge-shaped, each with several rows of obtuse spinules borne on the expanded top of a keel-like pedicle. A patch of bristles, pointed anteriorly, extending forward from base of caudal fin to below first ray of soft dorsal or beyond, present in both sexes.

Front of head and underside pale yellowish ; the sides dark, with numerous narrow pale lines enclosing lozenge-shaped areas of ground-colour, the whole pattern smaller and denser than in *S. diaspros* ; in young specimens the dark patches are smaller and may have a paler centre, resembling the rosette-markings of a jaguar. Forehead with 3 or 4 dark transverse bands, and several dark bars radiating from eye downwards and forwards across the cheek ; breast with a few dark spots.

Hab. Eastern Mediterranean ; Suez Canal ; Red Sea.

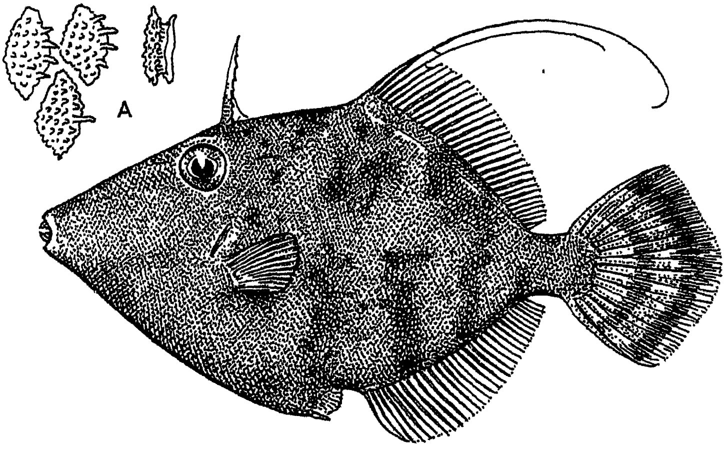
Described from 3 specimens, a male 200 mm. long and 2 females 205 mm. long, from Ismailia ; the male is selected as the holotype. In addition I have examined 9 others, from Cyprus, Palestine, Gulf of Suez, and Gulf of Akabar, in the British Museum collection ; also 1 from Grand Lac d'Amer received on loan from the Paris Museum by courtesy of Dr. Paul Chabanaud, to whom my thanks are due.

This is a very distinct species apparently derived from *S. diaspros*, but differing in the more slender form, much longer and more delicate dorsal spine, fewer dorsal and anal rays, one less pectoral ray, greater development of the caudal bristles, and different pattern. It may be added to the list of fishes which have passed right through the Suez Canal.

Stephanolepis rectifrons, sp. n.

Dorsal profile from tip of snout to base of first dorsal spine, straight, making a very slight angle with that of interdorsal space. Depth of body between origins of dorsal and anal fins contained $1\frac{2}{3}$ to $1\frac{4}{5}$ times in length of fish, length of head 3 times. Diameter of eye contained $3\frac{1}{2}$ to 4 times in length of head, equal to interorbital space. Distance from upper edge of orbit to base of first dorsal spine contained $1\frac{1}{2}$ to 2 times in diameter of eye. Length of snout contained 4 times in length of fish, shorter than interdorsal space, which is contained 3 times. Width of gill-opening equal to diameter of eye. Length of caudal peduncle contained 4 times in that of head. First dorsal spine half length of head, stout, with 6 or 7 strong, retrorse barbs on each posterior edge. Soft dorsal fin with 31 rays, the second and third sometimes filamentous; anal with 30–31 rays; pectoral with 13. Scales comparatively large, broad, roughly rhombic, each with a keel-like pedicle expanded above as a rhombic plate, bearing a number of

Fig. 6.



Stephanolepis rectifrons. Holotype. × $\frac{3}{5}$. A, scales.

obtuse spinules arranged in rows, from one to four of the posterior row enlarged and backwardly directed. Bristles on side of tail, when developed, not extending forward beyond posterior third of soft dorsal.

Dark brown, with numerous small blotches of black on sides, tending to form indistinct transverse bands between dorsal and anal fins; caudal fin with 2 dark transverse bands.

Hab. Zanzibar; Delagoa Bay.

Described above from 2 specimens; one, the holotype, 125 mm. long, is from Inyack, Delagoa Bay, in the collection of the British Museum (Nat. Hist.). The other is a smaller specimen from Zanzibar, received on loan from the Museum of Comparative Zoology, Cambridge, U.S.A. In addition I have examined 2 skins from Zanzibar in the British Museum collection.

The large head, straight profile, large scales, and very short caudal peduncle distinguish this species; the fin ray counts are lower than in the Southern African species which follows.

Stephanolepis auratus.

Monacanthus auratus Castelnau, 1861, Mém. Poiss. l'Afr.-Aust. p. 77.
Monacanthus setifer Gunther, 1870, Cat. Fish. Brit. Mus. viii. p. 239 (part); Gilchrist, 1902, Cat. Fishes S. Afr. p. 157; Gilchrist & Thompson, 1909, Ann. S. Afr. Mus. vi. pt. 3, p. 272; 1917, Ann. Durban Mus. i. pt. 4, p. 422 (part); Barnard, 1927, Ann. S. Afr. Mus. xxi. pt. 2, p. 955 (part); Smith, 1935, Rec. Albany Mus., Grahamstown, iv. p. 228, pl. xix. fig. B. Not of Bennett.

Hab. South Africa.

I have examined specimens from Knysna, Port Elizabeth, Port Alfred, Port Natal, and Durban, some of which have been lent by the Albany Museum, Grahamstown, through the kindness of Dr. J. L. B. Smith, to whom I express my thanks. All these examples clearly represent the form described by Castelnau. According to his description his fish had only 28 anal rays, but as in all the related species the difference between dorsal and anal fin-counts is rarely more than 1 ray, it may be assumed that the fin was damaged in his specimen.

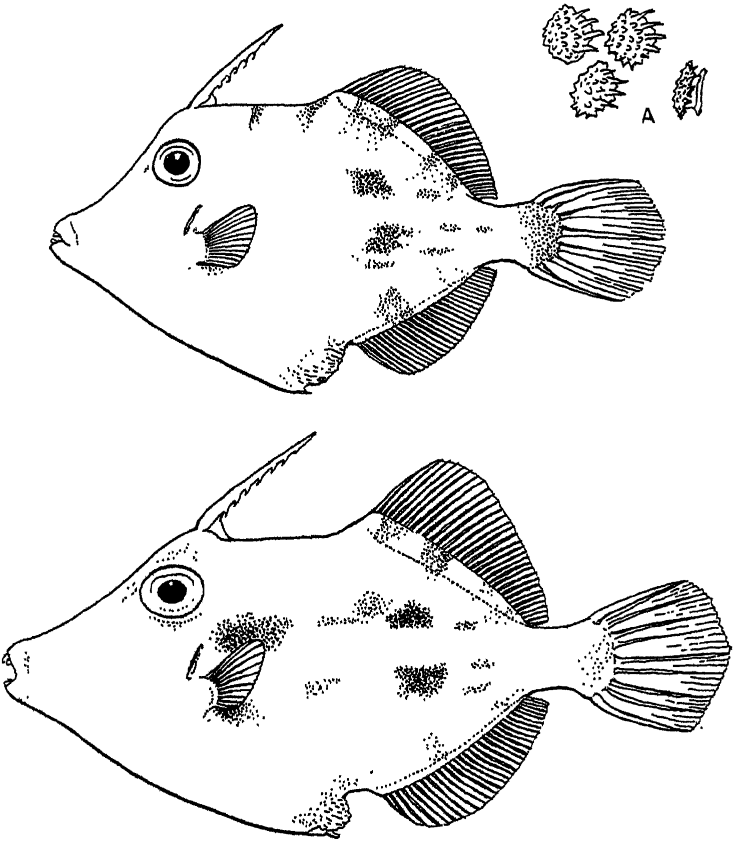
Stephanolepis varius.

Monacanthus varius Ranzani, 1842, Nov. Comm. Ac. Sci. Inst. Bonon. v. 6, pl. ii.
? *Monacanthus filamentosus* Troschel, 1866, Archiv. Naturg. p. 238.

Monacanthus setifer Günther, 1870, Cat. Fish. Brit. Mus. viii. p. 239 (part); ? Osorio, 1898, Journ. Sci. Math. Phys. Nat. Acad. Lisbon (2), v. p. 200; ? Pellegrin, 1907, Act. Soc. Linn. Bordeaux, lxii. p. 77; 1914, Ann. Inst. Oceanogr. Monaco, vi. (4) Poiss. p. 86. Not of Bennett.

Hab. Equatorial Atlantic, Coast of Brazil to West Africa.

Fig. 7.



Stephanolepis varius. × $\frac{7}{11}$.

The specimen above is from Rio de Janeiro, that below from Cape Verde. A, scales.

I have studed two examples of this species, from Rio de Janeiro (112 mm.) and Cape Verde (150 mm.), agreeing in all respects except for the depth of the body, which difference, however, alters the angles of the profile and makes them appear more different than they really are. The Brazilian specimen agrees well with Ranzani's description and figure. A very small example from Old Calabar belongs apparently to this species, and has the two dark patches on the side very pronounced.

Stephanolepis hispidus.

Balistes hispidus Linnæus, 1766, Syst. Nat. ed. xii. p. 405.

Balistes broccus Mitchill, 1815, Trans. Lit. Philo. Soc. N.Y. i. p. 467.

Monacanthus filamentosus Valenciennes, in Webb & Berthelot, 1844, Hist. Nat. Iles Canaries, ii. pt. 2, p. 95; Steindachner, 1865, Sitz. Akad. Wiss. Wien, li. (1), p. 403.

Monacanthus gallinula Valenciennes, *loc. cit.* p. 95.

Monacanthus massachusettensis De Kay, 1842, Fauna New York, Fishes, p. 336, pl. lvii. fig. 187.

Monacanthus setifer De Kay, 1842, Fauna New York, Fishes, p. 337, pl. lix. fig. 194; Gunther, 1870, Cat. Fish. Brit. Mus. viii. p. 239 (part); 1880, 'Challenger' Rep. i. p. 3; Rochebrune, 1883, Faune Sénégambie, Poiss. p. 154; Vinciguerra, 1892, Atti. Soc. Ital. Sci. Nat. xxxiv. p. 334; Metzelaar, 1919, Rapp. Kol. Curaçao, ii. p. 294; Chabanaud & Monod, 1926, Bull. Etud-Hist. Sci. Afr.-Occ. française, p. 287. Not of Bennett.

Monacanthus signifer Storer, 1846, Mem. Amer. Acad. new ser. ii. p. 245.

Stephanolepis setifer Gill, 1861, Proc. Acad. Nat. Sci., Philadelphia, p. 78.

Monacanthus broccus Jordan & Gilbert, 1882, Bull. U.S. Nat. Mus. xvi. (1883), p. 856.

Monacanthus hispidus Jordan & Evermann, 1898, Bull. U.S. Nat. Mus. xlvii. p. 1715 (part), pl. cclix. fig. 635; Smith, 1898, Bull. U.S. Fish. Comm. xvii. p. 104; Evermann & Marsh, 1900, Bull. U.S. Fish. Comm. xx. (1902) p. 259, fig. 72; Smith, 1907, N. Carolina Geol. and Econ. Survey, p. 346, fig. 153; Nichols, 1912, Bull. Amer. Mus. Nat. Hist. xxxi. fig. 3; Bigelow & Welsh, 1924, Bull. U.S. Bur. Fish. xl. pt. 1 (1925), p. 295, fig. 135; Nichols & Breder, 1927, 'Zoologica,' ix. no. 1, p. 137, fig. 193; Hildebrand & Schroeder, 1927, Bull. U.S. Bur. Fish. xliii. pt. 1 (1928), p. 342, fig. 205; Meek & Hildebrand, 1928, Field Mus. Nat. Hist. Zool. ser. xv. pt. 3, p. 797; Townsend, 1929, 'Zoologica,' ix. no. 9, p. 340, pl. xxvi.; Hildebrand & Cable, 1930, Bull. U.S. Bur. Fish. xlvi. p. 482, figs. 98–101; Jordan, Evermann, & Clark, 1930, Rep. U.S. Fish. Comm. pt. 2, app. x. p. 494; Beebe & Hollister, 1935, 'Zoologica,' xix. no. 6, p. 221; Fowler, 1936, Bull. Amer. Mus. Nat. Hist. lxx. pt. 2, p. 1095, fig. 459.

Stephanolepis hispidus Fowler, 1905, Rep. New Jersey State Mus. (1906) p. 358, pl. lxxv.; 1906, Proc. Acad. Nat. Sci. Philad. March (July), p. 102; Breder, 1929, Field Book Mar. Fish. Atl. Coast, p. 226, fig.; Parr, 1930, Bull. Bingham Ocean Coll. iii. art. 4, p. 138.

Hab. North Atlantic, from Gulf of Maine south to Venezuela; eastward to Madeira and Canary Is.

This species appears to be almost as common at the Canaries as on the American coast, and a larger material than I have at present would very likely reveal subspecific differences between specimens from the two areas. On the American side, this form appears to be confined to the Atlantic seaboard, its place being taken in the Gulf of Mexico by *S. spilonotus* and in the Caribbean Sea by *S. setifer*. There are indications that the number of dorsal and anal rays increases northward, examples from the Lesser Antilles having usually 30–31 rays, those from Florida and N. Carolina 32, and those from New York 33 or even 34.

Stephanolepis spilonotus.

Monacanthus spilonotus Cope, 1870, Trans. Amer. Phil. Soc. Philadelphia, xiv. p. 476 ; Jordan & Gilbert, 1882, Bull. U.S. Nat. Mus. xvi. (1883) p. 857 ; Jordan & Evermann, 1898, Bull. U.S. Nat. Mus. xlvii. p. 1716.

Monacanthus bispidus Jordan & Evermann, 1898, Bull. U.S. Nat. Mus. xlvii. p. 1715 (part) ; Longley, 1933, Yearb. Carnegie Inst. Washington, xxxii. p. 295.

Hab. Gulf of Mexico.

Distinguished from *S. hispidus* by the different profile, the distance from upper edge of orbit to base of first dorsal spine about 1⅓ times the diameter of eye ; and the greater number of barbs on the dorsal spine.

The late Dr. Longley identified Cope's species with *S. hispidus*, presumably having examined the type ; consequently, although the inadequate description differs in many respects from specimens I have examined, I feel justified in believing that Cope's fish, from the Gulf of Mexico, was conspecific with those described here, and using his name in preference to creating another.

I have 5 good examples of this form, 45 to 165 mm. long, from Florida, Mississippi, and Cuba, received on loan from the Museum of Comparative Zoology.

Stephanolepis japonicus.

Balistes japonicus Tilesius, 1810, Mém. Soc. Moscou, ii. pl. xiii.

Monacanthus trachyderma Bleeker, 1860, Act. Soc. Sci. Indo-Nederl. viii. Japan, vi. p. 70 ; Gunther, 1870, Cat. Fish. Brit. Mus. viii. p. 229.

Stephanolepis japonicus Jordan & Fowler, 1902, Proc. U.S. Nat. Mus. xxv. p. 265, fig. 1.

Monacanthus japonicus Jordan, Tanaka, & Snyder, 1913, Cat. Fish Japan, Journ. Coll. Sci. Imp. Univ. Tokyo, xxxiii. 1, p. 93.

Hab. Japan.

I have not seen this species. It is well described and figured by Jordan and Fowler.

LII.—*Papers on Oriental* Carabidæ.—XXXVI.

By H. E. ANDREWES, F.R.E.S.

THIS short paper is published (i.) to propose some new generic names in place of others now found to be preoccupied, (ii.) to put on record a few discoveries in synonymy.

GNOPHERUS, nom. nov. for GNOPHODES Andrewes, 1923, Spol. Zeyl. xii. p. 244 (*nec* Doubleday, 1839).

LAMPETES, nom. nov. for LAMPROPHONUS Bates, 1889, Ann. Mus. Civ. Gen. xxvii. p. 101 (*nec* Morris, 1837).

MELANCHITON, nom. nov. for MELANODES Chaudoir, 1876, Rev. Mag. Zool. (3) iv. p. 360 (*nec* Guénée, 1857).

MELANCHROUS, nom. nov. for PATELLUS Chaudoir, 1882, Ann. Soc. Ent. Fr. (6) ii. p. 551 (*nec* Montfort, 1810).

MICROSCHEMUS, nom. nov. for MICROCOSMUS Chaudoir, 1878, Ann. Soc. Ent. Belg. xxi. p. 139 (*nec* Fee, 1830, *nec* Heller, 1877).

It may also be mentioned that PACHYMORPHA Hope (1838) was antedated by Gray (1835), but, as it is only a synonym of ANTHIA, no new name is required. (See Andr. 1939, Ann. Mag. Nat. Hist. (11) iii. p. 131.)

KANOLDIA Jedlička, 1931, Act. Soc. Ent. Čech. xxviii p. 27=EUCALATHUS Bates, 1883, Trans. Ent. Soc. Lond. p. 253. I have in my collection cotypes of three of Bates's species, and Mr. Jedlička kindly sent me a cotype of one of his.

Brachinus viridinitens Jedlička, 1939, Neue Carab. aus Ostasien, xii. p. 7=*B. æneicostis* Bates, 1883, Trans. Ent. Soc. Lond. p. 279. Here, again, I have in my collection cotypes of both species.

Galerita insulindæ Liebke, 1934, Arb. morph. tax. Ent. Berl. i. p. 280=*G. toreuta* Andrewes, 1933, Treubia, xiv. p. 283. Mr. Liebke was good enough to compare with his type a specimen of *G. toreuta* which I sent to him for this purpose.

FIG. 1

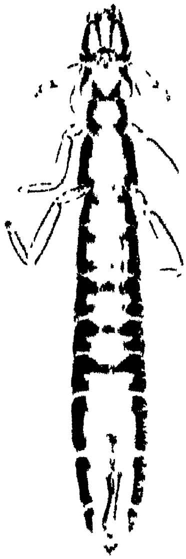


FIG. 2.

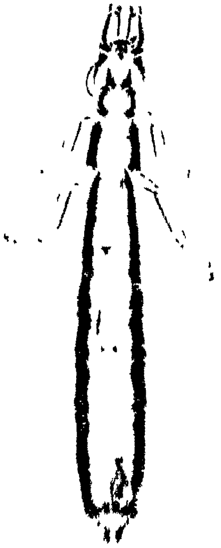


FIG. 3.

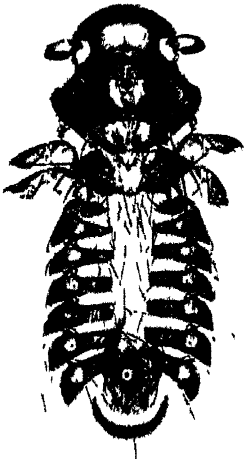
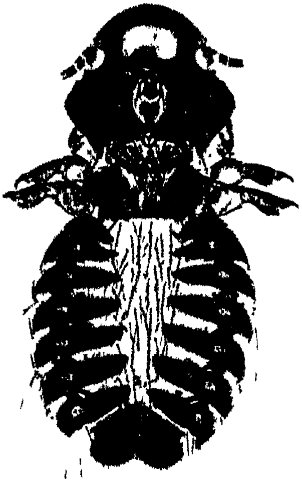


FIG. 4.



INDEX TO VOL. V.

ALEXANDER, C. P., on new or little-known Tipulidæ, 275.
Andrewes, H. E., on Oriental Carabidæ, 536.
Anthobosca, new species of, 103.
Arpactus, new species of, 105.
Arrenurus, new species of, 514.
Avga, gen. et sp. n., 490–492.
Bactria, new species of, 195.
Batrachyperus, new species of, 382.
Baylis, H. A., on parasitic worms from the Belgian Congo, 401.
Beyrichia, new species of, 392.
Bibliographical notice: Primitive Insects of South Australia (H. Womersley), 400.
Box, H. E., and Edwards, F. W., on Mosquitoes, 314.
Bythocypris, new species of, 396.
Callosiconops, gen. et sp. n., 75.
Camponotus, new species of, 47.
Chiasmocleis, new species of, 260.
China, W. E., on new South American Helotrephidæ, 106.
Chrysidiomyia, gen. et spp. nn., 73, 74.
Chrysozona, new species of, 193.
Cockerell, T. D. A., descriptions and records of bees, 82, 246.
Conops, new species of, 233.
Cox, L. R., on the palæontology of Afghanistan, 362.
Cryptolabis, new species of, 296.
Delkeskampomyia, gen. et sp. n., 71.
Donisthorpe, H., on new species of ants, 39.
Edwards, F. W., and Box, H. E., on Mosquitoes, 314.
Eleutherodactylus, new species of, 263.
Epactiothynnus, new species of, 93.
Ephutomorpha, new species of, 96–98.
Ericryphalus, new species of, 436, 437.
Erioptera, new species of, 293, 294.
Fraser-Brunner, A., on the plectognath fishes, 528.
Halictus, new species of, 83–90, 246–252.
Halipeurus, new species of, 499.
Haplistion, new species of, 11.
Harper, J. C., on the Upper Valentian ostracod fauna of Shropshire, 385.
Hering, E. M.: Eine neue Fruchtfliege als Bambus-Schädling (Dipt.), 322; on a new leaf-miner of the coffee-plant, 471.
Heteroconops, new species of, 67–69.
Hinton, H. E., on the Brazilian species of Neoelmis Musgrave, 129.
Holorusia, new species of, 276.
Hopkins, G. H. E., on Mallophaga, 417.
Hoplionota, new species of, 507–511.
Hylesinus, new species of, 433.
Hyman, L. H., on land planarians from the Pulau and Caroline Islands, Micronesia, 345.

Jonesites, new species of, 393.
Kimmins, D. E., on some types of Chrysopidæ in the British Museum, 442; on the genus Stilbopteryx Newman, 449.
Klœdenia, new species of, 394, 395.
Krober, O., Beitrage zur Kenntnis der Conopiden, 64, 203.
Leperditia, new species of, 389, 390.
Leptothorax, new species of, 45.
Lewis, H. P., on the microfossils of the Upper Carodocian phosphate deposits of Montgomeryshire, North Wales, 1.
Limonia, new species of, 283–287.
Liomyrmex, new species of, 40.
Luciogobius, new species of, 465.
Lygosoma, new species of, 265.
Machimus, new species of, 198.
Martino, V. and E., on the Yugoslavian ground-squirrels, 465; on new mammals from Jugoslavia, 493.
Matthai, G., on the skeleton in Astræid corals, 184.
Maulik, S., on the food-plant of Platyauchenia latreillei (Castelnau), 256.
Meggitt, F. J., on two tapeworms from a Burmese snake, 255.
Melanagromyza, new species of, 471.
Merriman, D., on the osteology of the striped bass, 55.
Microbrachyceræa, gen. nov., 217, 226.
Microconops, new species of, 76–79.
Mischocyttarus, new species of, 177–182.
Moreau, E. A., Parker, H. W., and Pakenham, R. H. W., *see* Parker, H. W.
Moy-Thomas, J. A., *see* White, Errol I.
Myopa, new species of, 80.
Neoconops, new species of, 66.
Neoelmis, new species of, 138–150.
Neotrephes, new species of, 107–112.
Neotrephinæ, subfam. nov., 123.
Neozeleboria, new species of, 94.
Ninia, new species of, 270.
Nixon, G. E. J., on new genera and species of Hormiinæ, 473.
Nysson, new species of, 104.
Oldroyd, H., on Abyssinian Diptera, 192.
Orectognathus, new species of, 46.
Oxodicera, new species of, 275.
Pakenham, R. H. W., Moreau, E. A., and Parker, H. W., *see* Parker, H. W.
Paraconops, new species of, 65, 66.
Parahormius, gen. et spp. nn., 473–489.
Paratrephes, gen. et sp. n., 117, 118.
Parker, H. W., on reptiles and amphibians, 257.
—, Moreau, E. A., and Pakenham, R. H. W., on the herpetology of the East African islands, 309.
Pelicerus, new species of, 439.
Phæospilodes, new species of, 322.
Phrynomerus, new species of, 261.
Phymatothynnus, new species of, 100.
Physocephala, new species of, 241.
Physoconops, new species of, 234.
Placoparina, gen. nov., 166.
Platymantis, new species of, 257.
Pocock, R. I., on the dugong, 329.
Pseudomyrma, new species of, 39.
Pseudophysocephala, gen. et sp. n., 221, 235.
Raillietina, new species of, 414.
Ramadan, M. M., on the first zoeal stage of Dotilla sulcata (Forskal), 253.
Regan, C. Tate, on the gobiid genus Luciogobius Gill, 462.
Rhagigaster, new species of, 102.
Richards, O. W., on new species of Mischocyttarus Saussure, 177.
Schedl, K. E., on Scolytidæ and Platypodidæ, 433.
Smartiomyia, gen. et sp. n., 72.
Smith, M. A., on the herpetology of Afghanistan, 382.
Spaeth, F.: Vier neue Hoplionota-Arten, 507.
Sphærodactylus, new species of, 264.
Stephanolepis, new species of, 529–531.
Stilbopteryx, new species of, 458, 460.
Stylogaster, new species of, 81.
Tachynomyia, new species of, 95.
Teucholabis, new species of, 288–292.
Thompson, G. B., on the type-hosts of the Mallophaga, 48, 297; on species of the genus Pectinopygus, 372; on species of the genus Pectinopygus, 429; on the

parasites of Australian birds and mammals, 498.
Thrasops, new species of, 273.
Thynnoturneria, new species of, 101.
Tipula, new species of, 277–282.
Tropidomyia, new species of, 225.
Turner, R. E., on fossorial Hymenoptera, 91, 96.
Uvarov, B. P., on new generic names in Orthoptera, 173.
Walter, C., on Hydracarina of Algeria, 513.
White, Errol I., and Moy-Thomas, J. A., on the nomenclature of fossil fishes, 502.
Whittard, W. F., on the Ordovician trilobite fauna of Shropshire, 153.
Woodward, Sir Arthur Smith, on the affinities of the Palæozoic Pleuracanth sharks, 323.
Xyleborus, new species of, 440, 441.
Zaspilothynnus, new species of, 92.
Zeuner, F. E., on a new subspecies of red deer from the Upper Pleistocene of Jersey, 326.
Zinn, D. J., on living ostracods in the intestinal tract of Triturus v. viridescens, 126.

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